Engineering

Assessment

FACILITY DESIGN

Testimony of Shahab Khoshmashrab and Steve Baker

SUMMARY OF CONCLUSIONS

Staff concludes that the design, construction and eventual closure of the project and its linear facilities would likely comply with applicable engineering laws, ordinances, regulations and standards. The proposed conditions of certification, below, would ensure compliance with these laws, ordinances, regulations and standards.

INTRODUCTION

Facility Design encompasses the civil, structural, mechanical and electrical engineering design of the project. The purpose of the Facility Design analysis is to:

- verify that the laws, ordinances, regulations and standards (LORS) applicable to the engineering design and construction of the project have been identified;
- verify that the project and ancillary facilities have been described in sufficient detail, including proposed design criteria and analysis methods, to provide reasonable assurance that the project can be designed and constructed in accordance with all applicable engineering LORS, and in a manner that assures public health and safety;
- determine whether special design features should be considered during final design to deal with conditions unique to the site which could influence public health and safety; and
- describe the design review and construction inspection process and establish conditions of certification that will be used to monitor and ensure compliance with the engineering LORS and any special design requirements.

Subjects discussed in this analysis include:

- Identification of the engineering LORS applicable to facility design;
- Evaluation of the applicant's proposed design criteria, including the identification of those criteria that are essential to ensuring public health and safety;
- Proposed modifications and additions to the Application for Certification (AFC) that are necessary to comply with applicable engineering LORS; and
- Conditions of certification proposed by staff to ensure that the project will be designed and constructed to assure public health and safety and comply with all applicable engineering LORS.

LAWS, ORDINANCES, REGULATIONS AND STANDARDS

Lists of LORS applicable to each engineering discipline (civil, structural, mechanical and electrical) are described in the AFC (SFERP 2004a, Appendices 10-A through 10-G) and are duplicated in Amendment A (SFPUC 2005a, Appendices 10-A through 10-G). Some of these LORS are listed in **Facility Design Table 1** below:

Facility Design Table 1
Some Engineering Laws, Ordinances, Regulations and Standards (LORS)

Applicable LORS	Description
Federal	Title 29 Code of Federal Regulations (CFR), Part 1910, Occupational Safety and Health Standards
State	2001 California Building Standards Code (CBSC) (also known as Title 24, California Code of Regulations)
Local	1997 Uniform Building Code (UBC), Appendix Chapter 16, Division 4
General	American National Standards Institute (ANSI) American Society of Mechanical Engineers (ASME) American Welding Society (AWS) American Society for Testing and Materials (ASTM)

SETTING

The project will be located on an approximately 4-acre site in the Potrero District of the City of San Francisco, County of San Francisco. The site will lie in seismic zone 4. For more information on the site and related project description, please see the **Project Description** section of this document. Additional engineering design details are contained in the AFC (SFERP 2004a, Appendices 10-A through 10-G) and are duplicated in Amendment A (SFPUC 2005a, Appendices 10-A through 10-G).

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

The purpose of this analysis is to ensure that the project is built to the applicable engineering codes in order to ensure public health and life safety. The analysis verifies that the applicable engineering LORS have been identified and that the project and ancillary facilities have been described in sufficient detail. It also evaluates the applicant's proposed design criteria, describes the design review and construction inspection process, and establishes conditions of certification to monitor and ensure compliance with the engineering LORS and any special design requirements. These conditions allow the Energy Commission Compliance Project Manager (CPM) and the applicant to adopt a compliance monitoring scheme that will verify compliance with these LORS.

COMPLIANCE WITH ENGINEERING LAWS, ORDINANCES, REGULATIONS AND STANDARDS

Staff has evaluated the proposed design criteria and construction methods for the project including its linear support facilities such as a natural gas pipeline and electric transmission line. The applicant proposes to use accepted industry standards (see SFPUC 2005a Appendices 10-A through 10-G and SFERP 2004a Appendices 10-A through 10-G for a representative list of applicable industry standards), design practices and construction methods in building the project. Staff concludes that the project, including its linear facilities, would most likely comply with all applicable engineering LORS, and proposes conditions of certification (see below and the **Geology and Paleontology** section of this document) to ensure compliance.

MAJOR STRUCTURES, SYSTEMS AND EQUIPMENT

Major structures, systems and equipment are defined as those structures and associated components or equipment that are necessary for power production and are costly to repair or replace, that require a long lead time to repair or replace, that are used for the storage, containment, or handling of hazardous or toxic materials, or may become potential health and safety hazards if not constructed according to the applicable engineering LORS. Major structures and equipment will be identified through compliance with proposed Condition of Certification **GEN-2** (below).

The AFC contains lists of the civil, structural, mechanical and electrical design criteria that demonstrate the likelihood of compliance with applicable engineering LORS, and that staff believes are essential to ensuring that the project is designed in a manner that protects public health and safety.

The project shall be designed and constructed to the 2001 edition of the California Building Standards Code (CBSC) (also known as Title 24, California Code of Regulations), which encompasses the California Building Code (CBC), California Building Standards Administrative Code, California Electrical Code, California Mechanical Code, California Plumbing Code, California Energy Code, California Fire Code, California Code for Building Conservation, California Reference Standards Code, and other applicable codes and standards in effect at the time design and construction of the project actually commences. In the event the initial designs are submitted to the Chief Building Official (CBO) for review and approval when the successor to the 2001 CBSC is in effect, the 2001 CBSC provisions, identified herein, shall be replaced with the applicable successor provisions.

Certain structures in a power plant may be required, under the CBC, to undergo dynamic lateral force (structural) analysis; others may be designed using the simpler static analysis procedure. In order to ensure that structures are analyzed using the appropriate lateral force procedure, staff has included Condition of Certification **STRUC-1** (below), which in part, requires review and approval by the CBO of the project owner's proposed lateral force procedures prior to the start of construction.

PROJECT QUALITY PROCEDURES

Amendment A (SFPUC 2005a, § 2.4.5) and the AFC (SFERP 2004a, § 2.4.5) describe a project Quality Program that will be used on the project to maximize confidence that systems and components will be designed, fabricated, stored, transported, installed and tested in accordance with the technical codes and standards appropriate for a power plant. Compliance with design requirements will be verified through an appropriate program of inspections and audits. Employment of this quality assurance/quality control (QA/QC) program would ensure that the project is actually designed, procured, fabricated, and installed as contemplated in this analysis.

COMPLIANCE MONITORING

Under Section 104.2 of the CBC, the building official is authorized and directed to enforce all the provisions of the CBC. For all energy facilities certified by the Energy Commission, the Energy Commission is the building official and has the responsibility to enforce the code. In addition, the Energy Commission has the power to render interpretations of the CBC and to adopt and enforce rules and supplemental regulations to clarify the application of the CBC's provisions.

The Energy Commission's design review and construction inspection process is developed to conform to CBC requirements and to ensure that all facility design conditions of certification are met. As provided by Section 104.2.2 of the CBC, the Energy Commission appoints experts to carry out the design review and construction inspections and act as delegate CBO on behalf of the Energy Commission. These delegates may include the local building official and/or independent consultants hired to cover technical expertise not provided by the local official. The applicant, through permit fees as provided by CBC Sections 107.2 and 107.3, pays the costs of the reviews and inspections. While building permits in addition to the Energy Commission certification are not required for this project, in lieu permit fees are paid by the applicant consistent with CBC Section 107, to cover the costs of reviews and inspections.

Engineering and compliance staff will consider the local building authority, the City and County, or a third party engineering consultant, to act as CBO for the project. When an entity has been identified to perform the duties of CBO, Energy Commission staff will complete a Memorandum of Understanding (MOU) with that entity that outlines its roles and responsibilities and those of its subcontractors and delegates.

Staff has developed proposed conditions of certification to ensure public health and safety and compliance with engineering design LORS. Some of these conditions address the roles, responsibilities and qualifications of the applicant's engineers responsible for the design and construction of the project (proposed Conditions of Certification **GEN-1** through **GEN-8**). Engineers responsible for the design of the civil, structural, mechanical and electrical portions of the project are required to be registered in California, and to sign and stamp each submittal of design plans, calculations and specifications submitted to the CBO. These conditions require that no element of construction subject to CBO review and approval shall proceed without prior approval from the CBO. They also require that qualified special inspectors be assigned to perform or oversee special inspections required by the applicable LORS.

While the Energy Commission and delegate CBO have the authority to allow some flexibility in scheduling construction activities, these conditions are written to require that no element of construction of permanent facilities subject to CBO review and approval, which would be difficult to reverse or correct, may proceed without prior approval of plans by the CBO. Those elements of construction that are not difficult to reverse are allowed to proceed without approval of the plans. The applicant shall bear the responsibility to fully modify those elements of construction to comply with all design changes that result from the CBO's subsequent plan review and approval process.

FACILITY CLOSURE

The removal of a facility from service, or decommissioning, as a result of the project reaching the end of its useful life, may range from "mothballing" to removal of all equipment and appurtenant facilities and restoration of the site. Future conditions that may affect the decommissioning decision are largely unknown at this time.

In order to assure that decommissioning of the facility will be completed in a manner that is environmentally sound, safe and will protect public health and safety, the applicant shall submit a decommissioning plan to the Energy Commission for review and approval prior to the commencement of decommissioning. The plan shall include a discussion of:

- proposed decommissioning activities for the project and all appurtenant facilities constructed as part of the project;
- all applicable LORS, local/regional plans and the conformance of the proposed decommissioning activities to the applicable LORS and local/regional plans;
- the activities necessary to restore the site if the plan requires removal of all equipment and appurtenant facilities; and
- decommissioning alternatives, other than complete site restoration.

The above requirements should serve as adequate protection, even in the unlikely event of project abandonment. Staff has proposed general conditions (see **General Conditions**) to ensure that these measures are included in the Facility Closure plan.

RESPONSE TO AGENCY AND PUBLIC COMMENTS

Staff received no comments in the area of Facility Design.

CONCLUSIONS

1. The laws, ordinances, regulations and standards (LORS) identified in the AFC and supporting documents are those applicable to the project.
2. Staff has evaluated the proposed engineering LORS, design criteria and design methods in the record, and concludes that the design, construction and eventual closure of the project are likely to comply with applicable engineering LORS.

3. The conditions of certification proposed will ensure that the facilities can be designed and constructed in accordance with applicable engineering LORS. This will occur through the use of design review, plan checking and field inspections, which are to be performed by the CBO or other Energy Commission delegate. Staff will audit the CBO to ensure satisfactory performance.
4. Whereas future conditions that may affect decommissioning are largely unknown at this time, it can reasonably be concluded that if the project owner submits a decommissioning plan as required in the **General Conditions** portion of this document prior to the commencement of decommissioning, the decommissioning procedure is likely to occur in compliance with all applicable engineering LORS.

Energy Commission staff recommends that:

1. The conditions of certification proposed herein be adopted to ensure that the project is designed and constructed to assure public health and safety, and to ensure compliance with all applicable engineering LORS;
2. The project be designed and built to the 2001 CBSC (or successor standard, if such is in effect when the initial project engineering designs are submitted for review); and
3. The CBO shall review the final designs, conduct plan checking and perform field inspections during construction. Energy Commission staff shall audit and monitor the CBO to ensure satisfactory performance.

CONDITIONS OF CERTIFICATION

GEN-1 The project owner shall design, construct and inspect the project in accordance with the 2001 California Building Standards Code (CBSC) (also known as Title 24, California Code of Regulations), which encompasses the California Building Code (CBC), California Building Standards Administrative Code, California Electrical Code, California Mechanical Code, California Plumbing Code, California Energy Code, California Fire Code, California Code for Building Conservation, California Reference Standards Code, and all other applicable engineering LORS in effect at the time initial design plans are submitted to the CBO for review and approval. (The CBSC in effect is that edition that has been adopted by the California Building Standards Commission and published at least 180 days previously.) The project owner shall insure that all the provisions of the above applicable codes be enforced during any construction, addition, alteration, moving, demolition, repair, or maintenance of the completed facility [2001 CBC, Section 101.3, Scope]. All transmission facilities (lines, switchyards, switching stations and substations) are handled in Conditions of Certification in the **Transmission System Engineering** section of this document.

In the event that the initial engineering designs are submitted to the CBO when a successor to the 2001 CBSC is in effect, the 2001 CBSC provisions identified herein shall be replaced with the applicable successor provisions. Where, in any specific case, different sections of the code specify different materials, methods of construction or other requirements, the most restrictive shall govern. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall govern.

The project owner shall insure that all contracts with contractors, subcontractors and suppliers shall clearly specify that all work performed and materials supplied on this project comply with the codes listed above.

Verification: Within 30 days after receipt of the Certificate of Occupancy, the project owner shall submit to the Compliance Project Manager (CPM) a statement of verification, signed by the responsible design engineer, attesting that all designs, construction, installation and inspection requirements of the applicable LORS and the Energy Commission's Decision have been met in the area of facility design. The project owner shall provide the CPM a copy of the Certificate of Occupancy within 30 days of receipt from the CBO [2001 CBC, Section 109 – Certificate of Occupancy].

Once the Certificate of Occupancy has been issued, the project owner shall inform the CPM at least 30 days prior to any construction, addition, alteration, moving, demolition, repair, or maintenance to be performed on any portion(s) of the completed facility which may require CBO approval for the purpose of complying with the above stated codes. The CPM will then determine the necessity of CBO approval on the work to be performed.

GEN-2 Prior to submittal of the initial engineering designs for CBO review, the project owner shall furnish to the CPM and to the CBO a schedule of facility design submittals, a Master Drawing List and a Master Specifications List. The schedule shall contain a list of proposed submittal packages of designs, calculations and specifications for major structures and equipment. To facilitate audits by Energy Commission staff, the project owner shall provide specific packages to the CPM when requested.

Verification: At least 60 days (or project owner and CBO approved alternative timeframe) prior to the start of rough grading, the project owner shall submit to the CBO and to the CPM the schedule, the Master Drawing List and the Master Specifications List of documents to be submitted to the CBO for review and approval. These documents shall be the pertinent design documents for the major structures and equipment listed in **Facility Design Table 2** below. Major structures and equipment shall be added to or deleted from the table only with CPM approval. The project owner shall provide schedule updates in the Monthly Compliance Report.

Facility Design Table 2
Major Structures and Equipment List

Equipment/System	**Quantity (Plant)**
Combustion Turbine (CT) Foundation and Connections	3
CT Generator Foundation and Connections	3
SCR Stack Structure, Foundation and Connections	3
CT Main Transformer Foundation and Connections	3
CT Fire Protection Skid Foundation and Connections	3
Sprint System Skid Foundation and Connetctions	3

Equipment/System	**Quantity (Plant)**
NOx Water Injection Skid Foundation and Connections	3
SCR/CO Catalyst System Structure, Foundation and Connections	3
CEMS Structure, Foundation and Connections	3
Chiller/Cooling Tower Package Foundation and Connections	1
Auxiliary Cooling Pumps Foundation and Connections	2
Cooling Tower Chemical System Foundation and Connections	1
Administration/Control Room/Plant Operations Building Structure, Foundation and Connections	1
Plant Air Compressor Package Foundation and Connections	1
Bulk Caustic Storage (if required) Foundation and Connections	1
Bulk Acid Storage (if required) Foundation and Connections	1
Bulk Sodium Hypochlorite Tank Structure, Foundation and Connections	1
EDI Train Foundation and Connections	2
EDI Feed Pump Skid Foundation and Connections	1
RO Clean in Place Skid Foundation and Connections	1
RO Feed Pump Skid Foundation and Connections	1
RO Train Foundation and Connections	1
RO Cartridge Filters Foundation and Connections	1
Ultra Filtration System Waste Skid Foundation and Connections	1
Ultra Filtration System Trains Foundation and Connections	2
Ultra Filtration System Pump Skid Foundation and Connections	1
Air Blowers Foundation and Connections	2
Chemical Metering System Foundation and Connections	1
Equalization Tank Structure, Foundation and Connections	1
Bio Reactor Structure, Foundation and Connections	1
Ultra Filtration Permeate Tank Structure, Foundation and Connections	1
Aqueous Ammonia Forwarding Pumps Foundation and Connections	2
Aqueous Ammonia Storage Tank Structure, Foundation and Connections	1
RO Permeate Tank Structure, Foundation and Connections	1
Treated Water Pumps Foundation and Connections	2
Treated Water Storage Tank Structure, Foundation and Connections	1
Oil/Water Separator Foundation and Connections	1
Waste Water Sump and Lift Station Foundation and Connections	1
DI Water Pumps Foundation and Connections	2
DI Water Storage Tank Structure, Foundation and Connections	1
Turbine Wash Water Drain Tank Structure, Foundation and Connections	1
Natural Gas Inlet Scrubber	1
Hydrocarbon Drain Tank Structure, Foundation and Connections	1
Discharge Filter Scrubbers Foundation and Connections	2
Fuel Gas Compressors Foundation and Connections	4

Equipment/System	**Quantity (Plant)**
Fuel Gas Cooling Radiators Foundation and Connections	4
Natural Gas Metering Station Foundation and Connections	1
Hydrocarbon Drain Tank Foundation and Connections	1
13.8kV/115kV GSUs Foundation and Connections	3
Auxiliary Transformers Foundation and Connections	2
Fire Blast Walls Structure, Foundation and Connections	3
Switchgears Structure, Foundation and Connections	2
Station Service Transformer Foundation and Connections	4
Retaining Wall Structure, Foundation and Connections	1
Reclaimed Water Treatment Building Structure, Foundation and Connections	1
Supplemental Aeration Blowers Foundation and Connections	2
Membrane Air Scour Blowers Foundation and Connections	2
Drain Pump Foundation and Connections	1
Permeate Pumps Foundation and Connections	2
Mixed Liquor Recirculation Pumps Foundation and Connections	2
CIP/Backpulse Pumps Foundation and Connections	2
CIP/Backpulse Tank Structure, Foundation and Connections	1
DIP Tank Recirculation/Drain Pumps Foundation and Connections	2
DIP Tank Structure, Foundation and Connections	2
Membrane Tanks Structure, Foundation and Connections	2
Feed Channel Structure, Foundation and Connections	1
Combined Inlet System Structure, Foundation and Connections	1
Potable Water Systems	1 Lot
Drainage Systems (including sanitary drain and waste)	1 Lot
High Pressure and Large Diameter Piping and Pipe Racks	1 Lot
HVAC and Refrigeration Systems	1 Lot
Temperature Control and Ventilation Systems (including water and sewer connections)	1 Lot
Building Energy Conservation Systems	1 Lot
Switchyard, Buses and Towers	1 Lot
Electrical Duct Banks	1 Lot

GEN-3 The project owner shall make payments to the CBO for design review, plan check and construction inspection based upon a reasonable fee schedule to be negotiated between the project owner and the CBO. These fees may be consistent with the fees listed in the 2001 CBC [Chapter 1, Section 107 and Table 1-A, Building Permit Fees; Appendix Chapter 33, Section 3310 and Table A-33-A, Grading Plan Review Fees; and Table A-33-B, Grading Permit Fees], adjusted for inflation and other appropriate adjustments; may be based on the value of the facilities reviewed; may be based on hourly rates; or may be as otherwise agreed by the project owner and the CBO.

Verification: The project owner shall make the required payments to the CBO in accordance with the agreement between the project owner and the CBO. The project owner shall send a copy of the CBO's receipt of payment to the CPM in the next Monthly Compliance Report indicating that the applicable fees have been paid.

GEN-4 Prior to the start of rough grading, the project owner shall assign a California registered architect, structural engineer or civil engineer, as a resident engineer (RE), to be in general responsible charge of the project [Building Standards Administrative Code (Cal. Code Regs., tit. 24, § 4-209, Designation of Responsibilities)]. All transmission facilities (lines, switchyards, switching stations and substations) are handled in Conditions of Certification in the **Transmission System Engineering** section of this document.

The RE may delegate responsibility for portions of the project to other registered engineers. Registered mechanical and electrical engineers may be delegated responsibility for mechanical and electrical portions of the project, respectively. A project may be divided into parts, provided each part is clearly defined as a distinct unit. Separate assignment of general responsible charge may be made for each designated part.

The RE shall:

1. Monitor construction progress of work requiring CBO design review and inspection to ensure compliance with LORS;
2. Ensure that construction of all the facilities subject to CBO design review and inspection conforms in every material respect to the applicable LORS, these conditions of certification, approved plans, and specifications;
3. Prepare documents to initiate changes in the approved drawings and specifications when directed by the project owner or as required by conditions on the project;
4. Be responsible for providing the project inspectors and testing agency(ies) with complete and up-to-date set(s) of stamped drawings, plans, specifications and any other required documents;
5. Be responsible for the timely submittal of construction progress reports to the CBO from the project inspectors, the contractor, and other engineers who have been delegated responsibility for portions of the project; and
6. Be responsible for notifying the CBO of corrective action or the disposition of items noted on laboratory reports or other tests as not conforming to the approved plans and specifications.

The RE shall have the authority to halt construction and to require changes or remedial work, if the work does not conform to applicable requirements.

If the RE or the delegated engineers are reassigned or replaced, the project owner shall submit the name, qualifications and registration number of the newly assigned engineer to the CBO for review and approval. The project owner shall notify the CPM of the CBO's approval of the new engineer.

Verification: At least 30 days (or project owner and CBO approved alternative timeframe) prior to the start of rough grading, the project owner shall submit to the CBO for review and approval, the resume and registration number of the RE and any other delegated engineers assigned to the project. The project owner shall notify the CPM of the CBO's approvals of the RE and other delegated engineer(s) within five days of the approval.

If the RE or the delegated engineer(s) are subsequently reassigned or replaced, the project owner has five days in which to submit the resume and registration number of the newly assigned engineer to the CBO for review and approval. The project owner shall notify the CPM of the CBO's approval of the new engineer within five days of the approval.

GEN-5 Prior to the start of rough grading, the project owner shall assign at least one of each of the following California registered engineers to the project: A) a civil engineer; B) a soils engineer, or a geotechnical engineer or a civil engineer experienced and knowledgeable in the practice of soils engineering; and C) an engineering geologist. Prior to the start of construction, the project owner shall assign at least one of each of the following California registered engineers to the project: D) a design engineer, who is either a structural engineer or a civil engineer fully competent and proficient in the design of power plant structures and equipment supports; E) a mechanical engineer; and F) an electrical engineer. [California Business and Professions Code section 6704 et seq., and sections 6730, 6731 and 6736 requires state registration to practice as a civil engineer or structural engineer in California.] All transmission facilities (lines, switchyards, switching stations and substations) are handled in Conditions of Certification in the **Transmission System Engineering** section of this document.

The tasks performed by the civil, mechanical, electrical or design engineers may be divided between two or more engineers, as long as each engineer is responsible for a particular segment of the project (e.g., proposed earthwork, civil structures, power plant structures, equipment support). No segment of the project shall have more than one responsible engineer. The transmission line may be the responsibility of a separate California registered electrical engineer.

The project owner shall submit to the CBO for review and approval, the names, qualifications and registration numbers of all responsible engineers assigned to the project [2001 CBC, Section 104.2, Powers and Duties of Building Official].

If any one of the designated responsible engineers is subsequently reassigned or replaced, the project owner shall submit the name, qualifications and registration number of the newly assigned responsible engineer to the CBO for review and approval. The project owner shall notify the CPM of the CBO's approval of the new engineer.

A. The civil engineer shall:

   1. Review the Foundation Investigations Report, Geotechnical Report or Soils Report prepared by the soils engineer, the geotechnical engineer, or by a civil engineer experienced and knowledgeable in the practice of soils engineering;

   2. Design, or be responsible for design, stamp, and sign all plans, calculations and specifications for proposed site work, civil works and related facilities requiring design review and inspection by the CBO. At a minimum, these include: grading, site preparation, excavation, compaction, construction of secondary containment, foundations, erosion and sedimentation control structures, drainage facilities, underground utilities, culverts, site access roads and sanitary sewer systems; and

   3. Provide consultation to the RE during the construction phase of the project and recommend changes in the design of the civil works facilities and changes in the construction procedures.

B. The soils engineer, geotechnical engineer, or civil engineer experienced and knowledgeable in the practice of soils engineering, shall:

   1. Review all the engineering geology reports;

   2. Prepare the Foundation Investigations Report, Geotechnical Report or Soils Report containing field exploration reports, laboratory tests and engineering analysis detailing the nature and extent of the soils that may be susceptible to liquefaction, rapid settlement or collapse when saturated under load [2001 CBC, Appendix Chapter 33, Section 3309.5, Soils Engineering Report; Section 3309.6, Engineering Geology Report; and Chapter 18, Section 1804, Foundation Investigations];

   3. Be present, as required, during site grading and earthwork to provide consultation and monitor compliance with the requirements set forth in the 2001 CBC, Appendix Chapter 33; Section 3317, Grading Inspections (depending on the site conditions, this may be the responsibility of either the soils engineer or engineering geologist or both); and

   4. Recommend field changes to the civil engineer and RE.

This engineer shall be authorized to halt earthwork and to require changes if site conditions are unsafe or do not conform with predicted conditions used as a basis for design of earthwork or foundations [2001 CBC, section 104.2.4, Stop orders].

C. The engineering geologist shall:

   1. Review all the engineering geology reports and prepare final soils grading report; and

2. Be present, as required, during site grading and earthwork to provide consultation and monitor compliance with the requirements set forth in the 2001 CBC, Appendix Chapter 33; Section 3317, Grading Inspections (depending on the site conditions, this may be the responsibility of either the soils engineer or engineering geologist or both).

D. The design engineer shall:

1. Be directly responsible for the design of the proposed structures and equipment supports;
2. Provide consultation to the RE during design and construction of the project;
3. Monitor construction progress to ensure compliance with engineering LORS;
4. Evaluate and recommend necessary changes in design; and
5. Prepare and sign all major building plans, specifications and calculations.

E. The mechanical engineer shall be responsible for, and sign and stamp a statement with, each mechanical submittal to the CBO, stating that the proposed final design plans, specifications, and calculations conform with all of the mechanical engineering design requirements set forth in the Energy Commission's Decision.

F. The electrical engineer shall:

1. Be responsible for the electrical design of the project; and
2. Sign and stamp electrical design drawings, plans, specifications, and calculations.

Verification: At least 30 days (or project owner and CBO approved alternative timeframe) prior to the start of rough grading, the project owner shall submit to the CBO for review and approval, resumes and registration numbers of the responsible civil engineer, soils (geotechnical) engineer and engineering geologist assigned to the project.

At least 30 days (or project owner and CBO approved alternative timeframe) prior to the start of construction, the project owner shall submit to the CBO for review and approval, resumes and registration numbers of the responsible design engineer, mechanical engineer and electrical engineer assigned to the project.

The project owner shall notify the CPM of the CBO's approvals of the responsible engineers within five days of the approval.

If the designated responsible engineer is subsequently reassigned or replaced, the project owner has five days in which to submit the resume and registration number of the newly assigned engineer to the CBO for review and approval. The project owner shall notify the CPM of the CBO's approval of the new engineer within five days of the approval.

GEN-6 Prior to the start of an activity requiring special inspection, the project owner shall assign to the project, qualified and certified special inspector(s) who shall be responsible for the special inspections required by the 2001 CBC, Chapter 17 [Section 1701, Special Inspections; Section 1701.5, Type of Work (requiring special inspection)]; and Section 106.3.5, Inspection and observation program. All transmission facilities (lines, switchyards, switching stations and substations) are handled in Conditions of Certification in the **Transmission System Engineering** section of this document.

The special inspector shall:

1. Be a qualified person who shall demonstrate competence, to the satisfaction of the CBO, for inspection of the particular type of construction requiring special or continuous inspection;
2. Observe the work assigned for conformance with the approved design drawings and specifications;
3. Furnish inspection reports to the CBO and RE. All discrepancies shall be brought to the immediate attention of the RE for correction, then, if uncorrected, to the CBO and the CPM for corrective action [2001 CBC, Chapter 17, Section 1701.3, Duties and Responsibilities of the Special Inspector]; and
4. Submit a final signed report to the RE, CBO, and CPM, stating whether the work requiring special inspection was, to the best of the inspector's knowledge, in conformance with the approved plans and specifications and the applicable provisions of the applicable edition of the CBC.

   A certified weld inspector, certified by the American Welding Society (AWS), and/or ASME as applicable, shall inspect welding performed on-site requiring special inspection (including structural, piping, tanks and pressure vessels).

<u>**Verification:**</u> At least 15 days (or project owner and CBO approved alternative timeframe) prior to the start of an activity requiring special inspection, the project owner shall submit to the CBO for review and approval, with a copy to the CPM, the name(s) and qualifications of the certified weld inspector(s), or other certified special inspector(s) assigned to the project to perform one or more of the duties set forth above. The project owner shall also submit to the CPM a copy of the CBO's approval of the qualifications of all special inspectors in the next Monthly Compliance Report.

If the special inspector is subsequently reassigned or replaced, the project owner has five days in which to submit the name and qualifications of the newly assigned special inspector to the CBO for approval. The project owner shall notify the CPM of the CBO's approval of the newly assigned inspector within five days of the approval.

GEN-7 If any discrepancy in design and/or construction is discovered in any engineering work that has undergone CBO design review and approval, the project owner shall document the discrepancy and recommend the corrective action required [2001 CBC, Chapter 1, Section 108.4, Approval Required; Chapter 17, Section 1701.3, Duties and Responsibilities of the Special Inspector; Appendix Chapter 33, Section 3317.7, Notification of Noncompliance]. The discrepancy documentation shall be submitted to the CBO for review and approval. The discrepancy documentation shall reference this Condition of Certification and, if appropriate, the applicable sections of the CBC and/or other LORS.

Verification: The project owner shall transmit a copy of the CBO's approval of any corrective action taken to resolve a discrepancy to the CPM in the next Monthly Compliance Report. If any corrective action is disapproved, the project owner shall advise the CPM, within five days, of the reason for disapproval and the revised corrective action to obtain CBO's approval.

GEN-8 The project owner shall obtain the CBO's final approval of all completed work that has undergone CBO design review and approval. The project owner shall request the CBO to inspect the completed structure and review the submitted documents. The project owner shall notify the CPM after obtaining the CBO's final approval. The project owner shall retain one set of approved engineering plans, specifications and calculations (including all approved changes) at the project site or at another accessible location during the operating life of the project [2001 CBC, Section 106.4.2, Retention of Plans]. Electronic copies of the approved plans, specifications, calculations and marked-up as-builts shall be provided to the CBO for retention by the CPM.

Verification: Within 15 days of the completion of any work, the project owner shall submit to the CBO, with a copy to the CPM, in the next Monthly Compliance Report, (a) a written notice that the completed work is ready for final inspection, and (b) a signed statement that the work conforms to the final approved plans. After storing final approved engineering plans, specifications and calculations as described above, the project owner shall submit to the CPM a letter stating that the above documents have been stored and indicate the storage location of such documents.

Within 90 days of the completion of construction, the project owner shall provide to the CBO three sets of electronic copies of the above documents at the project owner's expense. These are to be provided in the form of "read only" adobe .pdf 6.0 files, with restricted printing privileges (i.e. password protected), on archive quality compact discs.

CIVIL-1 The project owner shall submit to the CBO for review and approval the following:

1. Design of the proposed drainage structures and the grading plan;
2. An erosion and sedimentation control plan;
3. Related calculations and specifications, signed and stamped by the responsible civil engineer; and

4. Soils Report, Geotechnical Report or Foundation Investigations Report required by the 2001 CBC [Appendix Chapter 33, Section 3309.5, Soils Engineering Report; Section 3309.6, Engineering Geology Report; and Chapter 18, Section 1804, Foundation Investigations].

<u>Verification:</u> At least 15 days (or project owner and CBO approved alternative timeframe) prior to the start of site grading the project owner shall submit the documents described above to the CBO for design review and approval. In the next Monthly Compliance Report following the CBO's approval, the project owner shall submit a written statement certifying that the documents have been approved by the CBO.

CIVIL-2 The resident engineer shall, if appropriate, stop all earthwork and construction in the affected areas when the responsible soils engineer, geotechnical engineer, or the civil engineer experienced and knowledgeable in the practice of soils engineering identifies unforeseen adverse soil or geologic conditions. The project owner shall submit modified plans, specifications and calculations to the CBO based on these new conditions. The project owner shall obtain approval from the CBO before resuming earthwork and construction in the affected area [2001 CBC, Section 104.2.4, Stop orders].

<u>Verification:</u> The project owner shall notify the CPM within 24 hours, when earthwork and construction is stopped as a result of unforeseen adverse geologic/soil conditions. Within 24 hours of the CBO's approval to resume earthwork and construction in the affected areas, the project owner shall provide to the CPM a copy of the CBO's approval.

CIVIL-3 The project owner shall perform inspections in accordance with the 2001 CBC, Chapter 1, Section 108, Inspections; Chapter 17, Section 1701.6, Continuous and Periodic Special Inspection; and Appendix Chapter 33, Section 3317, Grading Inspection. All plant site-grading operations, for which a grading permit is required, shall be subject to inspection by the CBO.

If, in the course of inspection, it is discovered that the work is not being performed in accordance with the approved plans, the discrepancies shall be reported immediately to the resident engineer, the CBO and the CPM [2001 CBC, Appendix Chapter 33, Section 3317.7, Notification of Noncompliance]. The project owner shall prepare a written report, with copies to the CBO and the CPM, detailing all discrepancies, non-compliance items, and the proposed corrective action.

<u>Verification:</u> Within five days of the discovery of any discrepancies, the resident engineer shall transmit to the CBO and the CPM a Non-Conformance Report (NCR), and the proposed corrective action for review and approval. Within five days of resolution of the NCR, the project owner shall submit the details of the corrective action to the CBO and the CPM. A list of NCRs, for the reporting month, shall also be included in the following Monthly Compliance Report.

CIVIL-4 After completion of finished grading and erosion and sedimentation control and drainage work, the project owner shall obtain the CBO's approval of the final grading plans (including final changes) for the erosion and sedimentation control work. The civil engineer shall state that the work within his/her area of responsibility was done in accordance with the final approved plans [1998 CBC, Section 3318, Completion of Work].

Verification: Within 30 days (or project owner and CBO approved alternative timeframe) of the completion of the erosion and sediment control mitigation and drainage work, the project owner shall submit to the CBO, for review and approval, the final grading plans (including final changes) and the responsible civil engineer's signed statement that the installation of the facilities and all erosion control measures were completed in accordance with the final approved combined grading plans, and that the facilities are adequate for their intended purposes, with a copy of the transmittal letter to the CPM. The project owner shall submit a copy of the CBO's approval to the CPM in the next Monthly Compliance Report.

STRUC-1 Prior to the start of any increment of construction of any major structure or component listed in **Facility Design Table 2** of Condition of Certification **GEN-2**, above, the project owner shall submit to the CBO for design review and approval the proposed lateral force procedures for project structures and the applicable designs, plans and drawings for project structures. Proposed lateral force procedures, designs, plans and drawings shall be those for the following items (from **Table 2**, above):

1. Major project structures;
2. Major foundations, equipment supports and anchorage;
3. Large field fabricated tanks;
4. Turbine/generator pedestal; and

Construction of any structure or component shall not commence until the CBO has approved the lateral force procedures to be employed in designing that structure or component.

The project owner shall:

1. Obtain approval from the CBO of lateral force procedures proposed for project structures;
2. Obtain approval from the CBO for the final design plans, specifications, calculations, soils reports and applicable quality control procedures. If there are conflicting requirements, the more stringent shall govern (i.e., highest loads, or lowest allowable stresses shall govern). All plans, calculations and specifications for foundations that support structures shall be filed concurrently with the structure plans, calculations and specifications [2001 CBC, Section 108.4, Approval Required];
3. Submit to the CBO the required number of copies of the structural plans, specifications, calculations and other required documents of the designated major structures prior to the start of on-site fabrication and installation of each structure, equipment support, or foundation [2001 CBC, Section 106.4.2, Retention of plans; and Section 106.3.2, Submittal documents];

4. Ensure that the final plans, calculations and specifications clearly reflect the inclusion of approved criteria, assumptions and methods used to develop the design. The final designs, plans, calculations and specifications shall be signed and stamped by the responsible design engineer [2001 CBC, Section 106.3.4, Architect or Engineer of Record]; and
5. Submit to the CBO the responsible design engineer's signed statement that the final design plans conform to the applicable LORS [2001 CBC, Section 106.3.4, Architect or Engineer of Record].

Verification: At least 60 days (or project owner and CBO approved alternative timeframe) prior to the start of any increment of construction of any structure or component listed in **Facility Design Table 2** of Condition of Certification **GEN-2** above, the project owner shall submit to the CBO the above final design plans, specifications and calculations, with a copy of the transmittal letter to the CPM.

The project owner shall submit to the CPM, in the next Monthly Compliance Report a copy of a statement from the CBO that the proposed structural plans, specifications and calculations have been approved and are in compliance with the requirements set forth in the applicable engineering LORS.

STRUC-2 The project owner shall submit to the CBO the required number of sets of the following documents related to work that has undergone CBO design review and approval:

1. Concrete cylinder strength test reports (including date of testing, date sample taken, design concrete strength, tested cylinder strength, age of test, type and size of sample, location and quantity of concrete placement from which sample was taken, and mix design designation and parameters);
2. Concrete pour sign-off sheets;
3. Bolt torque inspection reports (including location of test, date, bolt size, and recorded torques);
4. Field weld inspection reports (including type of weld, location of weld, inspection of non-destructive testing procedure and results, welder qualifications, certifications, qualified procedure description or number (ref: AWS); and
5. Reports covering other structural activities requiring special inspections shall be in accordance with the 2001 CBC, Chapter 17, Section 1701, Special Inspections; Section 1701.5, Type of Work (requiring special inspection); Section 1702, Structural Observation and Section 1703, Nondestructive Testing.

Verification: If a discrepancy is discovered in any of the above data, the project owner shall, within five days, prepare and submit an NCR describing the nature of the discrepancies and the proposed corrective action to the CBO, with a copy of the transmittal letter to the CPM [2001 CBC, Chapter 17, Section 1701.3, Duties and Responsibilities of the Special Inspector]. The NCR shall reference the Condition(s) of Certification and the applicable CBC chapter and section. Within five days of resolution of the NCR, the project owner shall submit a copy of the corrective action to the CBO and the CPM.

The project owner shall transmit a copy of the CBO's approval or disapproval of the corrective action to the CPM within 15 days. If disapproved, the project owner shall advise the CPM, within five days, the reason for disapproval, and the revised corrective action to obtain CBO's approval.

STRUC-3 The project owner shall submit to the CBO design changes to the final plans required by the 2001 CBC, Chapter 1, Section 106.3.2, Submittal documents and Section 106.3.3, Information on plans and specifications, including the revised drawings, specifications, calculations, and a complete description of, and supporting rationale for, the proposed changes, and shall give to the CBO prior notice of the intended filing.

Verification: On a schedule suitable to the CBO, the project owner shall notify the CBO of the intended filing of design changes, and shall submit the required number of sets of revised drawings and the required number of copies of the other above-mentioned documents to the CBO, with a copy of the transmittal letter to the CPM. The project owner shall notify the CPM, via the Monthly Compliance Report, when the CBO has approved the revised plans.

STRUC-4 Tanks and vessels containing quantities of toxic or hazardous materials exceeding amounts specified in Chapter 3, Table 3-E of the 2001 CBC shall, at a minimum, be designed to comply with the requirements of that Chapter.

Verification: At least 30 days (or project owner and CBO approved alternate timeframe) prior to the start of installation of the tanks or vessels containing the above specified quantities of toxic or hazardous materials, the project owner shall submit to the CBO for design review and approval final design plans, specifications and calculations, including a copy of the signed and stamped engineer's certification.

The project owner shall send copies of the CBO approvals of plan checks to the CPM in the following Monthly Compliance Report. The project owner shall also transmit a copy of the CBO's inspection approvals to the CPM in the Monthly Compliance Report following completion of any inspection.

MECH-1 The project owner shall submit, for CBO design review and approval, the proposed final design, specifications and calculations for each plant major piping and plumbing system listed in **Facility Design Table 2**, Condition of Certification **GEN-2**, above. Physical layout drawings and drawings not related to code compliance and life safety need not be submitted. The submittal shall also include the applicable QA/QC procedures. Upon completion of construction of any such major piping or plumbing system, the project owner shall request the CBO's inspection approval of said construction [2001 CBC, Section 106.3.2, Submittal Documents; Section 108.3, Inspection Requests; Section 108.4, Approval Required; 2001 California Plumbing Code, Section 103.5.4, Inspection Request; Section 301.1.1, Approval].

The responsible mechanical engineer shall stamp and sign all plans, drawings and calculations for the major piping and plumbing systems subject to the CBO design review and approval, and submit a signed statement to the CBO when the said proposed piping and plumbing systems have been designed, fabricated and installed in accordance with all of the applicable laws, ordinances, regulations and industry standards [Section 106.3.4, Architect or Engineer of Record], which may include, but not be limited to:

- American National Standards Institute (ANSI) B31.1 (Power Piping Code);
- ANSI B31.2 (Fuel Gas Piping Code);
- ANSI B31.3 (Chemical Plant and Petroleum Refinery Piping Code);
- ANSI B31.8 (Gas Transmission and Distribution Piping Code);
- Title 24, California Code of Regulations, Part 5 (California Plumbing Code);
- Title 24, California Code of Regulations, Part 6 (California Energy Code, for building energy conservation systems and temperature control and ventilation systems);
- Title 24, California Code of Regulations, Part 2 (California Building Code); and
- Specific City/County code.

The CBO may deputize inspectors to carry out the functions of the code enforcement agency [2001 CBC, Section 104.2.2, Deputies].

Verification: At least 30 days (or project owner and CBO approved alternative timeframe) prior to the start of any increment of major piping or plumbing construction listed in **Facility Design Table 2**, Condition of Certification **GEN-2** above, the project owner shall submit to the CBO for design review and approval the final plans, specifications and calculations, including a copy of the signed and stamped statement from the responsible mechanical engineer certifying compliance with the applicable LORS, and shall send the CPM a copy of the transmittal letter in the next Monthly Compliance Report.

The project owner shall transmit to the CPM, in the Monthly Compliance Report following completion of any inspection, a copy of the transmittal letter conveying the CBO's inspection approvals.

MECH-2 For all pressure vessels installed in the plant, the project owner shall submit to the CBO and California Occupational Safety and Health Administration (Cal-OSHA), prior to operation, the code certification papers and other documents required by the applicable LORS. Upon completion of the installation of any pressure vessel, the project owner shall request the appropriate CBO and/or Cal-OSHA inspection of said installation [2001 CBC, Section 108.3, Inspection Requests].

The project owner shall:

1. Ensure that all boilers and fired and unfired pressure vessels are designed, fabricated and installed in accordance with the appropriate section of the ASME Boiler and Pressure Vessel Code, or other applicable code. Vendor certification, with identification of applicable code, shall be submitted for prefabricated vessels and tanks; and
2. Have the responsible design engineer submit a statement to the CBO that the proposed final design plans, specifications and calculations conform to all of the requirements set forth in the appropriate ASME Boiler and Pressure Vessel Code or other applicable codes.

Verification: At least 30 days (or project owner and CBO approved alternative timeframe) prior to the start of on-site fabrication or installation of any pressure vessel, the project owner shall submit to the CBO for design review and approval, the above listed documents, including a copy of the signed and stamped engineer's certification, with a copy of the transmittal letter to the CPM.

The project owner shall transmit to the CPM, in the Monthly Compliance Report following completion of any inspection, a copy of the transmittal letter conveying the CBO's and/or Cal-OSHA inspection approvals.

MECH-3 The project owner shall submit to the CBO for design review and approval the design plans, specifications, calculations and quality control procedures for any heating, ventilating, air conditioning (HVAC) or refrigeration system. Packaged HVAC systems, where used, shall be identified with the appropriate manufacturer's data sheets.

The project owner shall design and install all HVAC and refrigeration systems within buildings and related structures in accordance with the CBC and other applicable codes. Upon completion of any increment of construction, the project owner shall request the CBO's inspection and approval of said construction. The final plans, specifications and calculations shall include approved criteria, assumptions and methods used to develop the design. In addition, the responsible mechanical engineer shall sign and stamp all plans, drawings and calculations and submit a signed statement to the CBO that the proposed final design plans, specifications and calculations conform with the applicable LORS [2001 CBC, Section 108.7, Other Inspections; Section 106.3.4, Architect or Engineer of Record].

Verification: At least 30 days (or project owner and CBO approved alternative timeframe) prior to the start of construction of any HVAC or refrigeration system, the project owner shall submit to the CBO the required HVAC and refrigeration calculations, plans and specifications, including a copy of the signed and stamped statement from the responsible mechanical engineer certifying compliance with the CBC and other applicable codes, with a copy of the transmittal letter to the CPM.

ELEC-1 Prior to the start of any increment of electrical construction for electrical equipment and systems 480 volts and higher, listed below, with the exception of underground duct work and any physical layout drawings and drawings not related to code compliance and life safety, the project owner shall submit, for CBO design review and approval, the proposed final design, specifications and calculations [CBC 2001, Section 106.3.2, Submittal documents]. Upon approval, the above listed plans, together with design changes and design change notices, shall remain on the site or at another accessible location for the operating life of the project. The project owner shall request that the CBO inspect the installation to ensure compliance with the requirements of applicable LORS [2001 CBC, Section 108.4, Approval Required, and Section 108.3, Inspection Requests]. All transmission facilities (lines, switchyards, switching stations and substations) are handled in Conditions of Certification in the **Transmission System Engineering** section of this document.

A. Final plant design plans to include:

1. one-line diagrams for the 13.8 kV, 4.16 kV and 480 V systems; and
2. system grounding drawings.

B. Final plant calculations to establish:

1. short-circuit ratings of plant equipment;
2. ampacity of feeder cables;
3. voltage drop in feeder cables;
4. system grounding requirements;
5. coordination study calculations for fuses, circuit breakers and protective relay settings for the 13.8 kV, 4.16 kV and 480 V systems;
6. system grounding requirements; and
7. lighting energy calculations.

C. The following activities shall be reported to the CPM in the Monthly Compliance Report:

1. Receipt or delay of major electrical equipment;
2. Testing or energization of major electrical equipment; and
3. A signed statement by the registered electrical engineer certifying that the proposed final design plans and specifications conform to requirements set forth in the Energy Commission Decision.

Verification: At least 30 days (or project owner and CBO approved alternative timeframe) prior to the start of each increment of electrical construction, the project owner shall submit to the CBO for design review and approval the above listed documents. The project owner shall include in this submittal a copy of the signed and stamped statement from the responsible electrical engineer attesting compliance with the applicable LORS, and shall send the CPM a copy of the transmittal letter in the next Monthly Compliance Report.

REFERENCES

SFERP 2004a — City and County of San Francisco/Blount (tn: 31130). Application for Certification, San Francisco Electric Reliability Project — 145 megawatt natural gas-fired peaking power plant located in San Francisco. Submitted to CEC/Therkelsen/Dockets on 3/18/04.

SFPUC 2005a — San Francisco Public Utilities Commission/Hale (tn: 34403). Amendment A of the Application for Certification. Submitted to CEC/Therkelsen/Dockets on 3/25/05.

GEOLOGY AND PALEONTOLOGY

Testimony of Patrick Pilling, Ph.D., P.E., G.E.

SUMMARY OF CONCLUSIONS

With the exception of strong ground shaking, potential liquefaction during an earthquake, and potential differential settlement of heavily loaded structures, the San Francisco Electric Reliability Project site lies in an area that generally exhibits low geologic hazards and no known viable geologic or mineralogic resources. Strong ground shaking, potential liquefaction, and potential differential settlement must be mitigated through foundation design as required by the California Building Code (2001) and conditions of certification. Paleontological Resources have been documented in the general area of the project. The potential impacts to paleontological resources due to construction activities will be mitigated as required by conditions of certification.

The potential for significant adverse cumulative impacts to the project from geologic hazards can be mitigated to an impact that is less than significant, and the potential for significant adverse cumulative impacts to potential geologic, mineralogic, and paleontologic resources from the construction, operation, and closure of the proposed project, is low. It is Energy Commission staff's opinion that the San Francisco Electric Reliability Project can be designed and constructed in accordance with all applicable laws, ordinances, regulations, and standards and in a manner that protects environmental quality and assures public health and safety.

INTRODUCTION

In this section, Energy Commission staff discusses potential impacts of the proposed San Francisco Electric Reliability Project (SFERP) regarding geologic hazards, geologic (including mineralogic), and paleontologic resources. Staff's objective is to ensure that there will be no significant adverse impacts to significant geological and paleontological resources during project construction, operation, and closure. A brief geological and paleontological overview of the project is provided. The section concludes with staff's proposed monitoring and mitigation measures with respect to geologic hazards and geologic, mineralogic, and paleontologic resources, with the inclusion of conditions of certification.

LAWS, ORDINANCES, REGULATION, AND STANDARDS

The applicable laws, ordinances, regulation and standards (LORS) are listed in the Application for Certification (AFC), in Section 8.15.2, Table 8.15-1, Section 8.16.2, and Table 8.16-1 (SFPUC 2005a). The following is a brief description of the LORS for geologic hazards and resources, and mineralogic and paleontologic resources.

Geology and Paleontology Table 1
Laws, Ordinances, Regulations, and Standards

Applicable Law	Description
Federal	The proposed SFERP is not located on federal land. There are no Federal LORS for geologic hazards and resources for this site.
State	
California Building Standards Code (CBSC), 2001 [particularly Part 2, California Building Code (CBC)]	The CBC includes a series of standards that are used in project investigation, design and construction (including grading and erosion control).
Local	None
Standard of Practice - Society for Vertebrate Paleontology (SVP), 1995	The "Measures for Assessment and Mitigation of Adverse Impacts to Non-renewable Paleontologic Resources: Standard Procedures" is a set of procedures and standards for assessing and mitigating impacts to vertebrate paleontological resources. The measures were adopted in October 1995 by the SVP, a national organization of professional scientists.

SETTING

The proposed SFERP site is a 4-acre parcel owned by the City of San Francisco near Potrero Point in San Francisco. The site is located north of the Islais Creek Channel between Cesar Chavez Street and 25th Street.

REGIONAL SETTING

The project site is located along the eastern side of the San Francisco Peninsula, near the San Francisco Bay and north of the Isais Creek Channel within the limits of the Potrero District. The San Francisco Peninsula lies within the northern Coast Ranges physiographic province. This province is characterized by a northwest-trending series of elongated ranges and narrow valleys and extends from the Oregon border to the Transverse Ranges in Southern California (Norris and Webb. 1990).

Potrero Point lies within the Hunters Point Shear Zone. This shear zone is an older structure that trends northwest across the peninsula and is part of the Coast Range Thrust Fault that juxtaposed the Franciscan Formation and Great Valley Sequence. The California Division of Mines and Geology (CDMG. 1994) considers the shear zone inactive. No known active faults cross the SFERP site.

Potrero Point was originally a spur of Potrero Hill, a serpentine bedrock rock mass of the Franciscan Formation that rose to a height of over 100 feet. During the 19th century the bay and tidelands immediately adjacent to Potrero Point were reclaimed, in part, with rock quarried from Potrero Point (Mace. 2002).

PROJECT SITE DESCRIPTION

The project site is relatively level and consists of reclaimed tidal flats. The site is immediately underlain by artificial fill, younger bay mud, upper layered sediments, older bay mud, lower layered sediments, and Franciscan-age bedrock (SFERP 2005ll). Based on information contained in the project geotechnical report (SFERP 2005ll), the thickness of the artificial fill materials varies from 21 to 31 feet across the site. The fill material generally consists of loose to medium dense, poorly graded to well-graded gravels and silty to clayey gravels and sands that contain rubble and debris (e.g. bricks, concrete, wood, and re-worked bedrock). Although the artificial fill could contain fossils since it is typically comprised of sediments from older deposits, any such fossils would lack stratigraphic context such that they would only have very limited scientific and educational value.

The younger bay mud that underlies the artificial fill site varies in thickness between 18 and 40 feet across the site (SFERP 2005ll). This unit is comprised of soft to stiff fat clay, and includes zones that exhibit trace to abundant shell fragments (SFERP 2005ll).

The upper layered sediments consist of interbedded alluvial and marine sediments that are comprised of silty and clayey sands, sandy to clayey silts, lean to fat clays, and clean poorly graded sands (SFERP 2005ll). The fine-grain soils in this unit are generally stiff to very stiff, while the granular soils are typically dense to very dense.

The layers of older bay mud are interfingered with the overlying upper layered sediments at depths between 70 and 90 feet and 110 and 135 feet below existing grade (SFERP 2005ll). This material is classified as stiff and as exhibiting a trace amount of shell fragments.

The lower layered sediments consist of a sequence of interbedded alluvial and marine sediments present at a depth between 135 and 158 feet below existing grade (SFERP 2005ll). These materials are classified as very stiff to hard alluvial sandy lean clays and marine deposited fat clays.

With the exception of the artificial fill that mantles the site, the above materials, which include early Holocene and late Pleistocene bay muds and sediments, have produced numerous significant plant, invertebrate, and vertebrate fossils at previously recorded fossil sites and, as a result, have a high potential for additional similar fossils to be uncovered by excavations for project construction that extend into native materials.

The Franciscan bedrock is primarily composed of serpentine, with occasional tectonic blocks of sandstones and shales. This unit has been dated as Jurassic, Cretaceous, and early Tertiary in age. The serpentine is generally moderately to highly weathered in the upper few feet, and becomes less weathered and very dense at depth. This formation is considered to have a low potential for containing fossils only because there is the possibility that excavations could encounter blocks of fossil-bearing sedimentary rock (SFPUC 2005a).

Ground water is expected to be present at depths that vary between 5 and 12 feet below existing grade.

Based on the information contained in the AFC (SFPUC 2005a) and local geologic maps, artificial fill materials and underlying sediments and bedrock are anticipated along the proposed process water supply pipeline, underground electrical, and natural gas pipeline alignments. Ground water is most likely present at elevations similar to those discussed above.

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

There are two types of impacts considered in this section. The first are geologic hazards, which could impact proper functioning of the proposed facility and include faulting and seismicity, liquefaction, dynamic compaction, hydrocompaction, subsidence, expansive soils, landslides, and tsunamis and seiches. The second considers potential impacts the proposed facility could have on existing geologic, mineralogic, and paleontologic resources in the area.

METHOD AND THRESHOLD FOR DETERMINING SIGNIFICANCE

No federal LORS with respect to geologic hazards and geologic and mineralogic resources apply to this project; however, the CBSC and CBC provide geotechnical and geological investigation and design guidelines, which engineers must adhere to when designing a proposed facility. As a result, the criteria used to assess geologic hazard impact significance includes evaluating each potential hazard in relation to being able to adequately design and construct the proposed facility.

The California Environmental Quality Act (CEQA) Guidelines, Appendix G, provides a checklist of questions that a lead agency should normally address if relevant to a project's environmental impacts.

- Section (V) (c) asks if the project will directly or indirectly destroy a unique paleontological resource or site or unique geological feature.
- Sections (VI) (a), (b), (c), (d), and (e) pose questions that are focused on whether or not the project would expose persons or structures to geologic hazards.
- Sections (X) (a) and (b) pose questions about the project's effect on mineral resources.

With respect to impacts the proposed facility may have on existing geologic and mineralogic resources, geologic and mineral resource maps for the surrounding area have been reviewed, in addition to any site-specific information provided by the applicant, to determine if geologic and mineralogic resources are present in the area. When available, operating procedures of the proposed facility, in particular ground water extraction and mass grading, are reviewed to determine if such operations could adversely impact such resources.

Staff reviewed existing paleontologic information for the surrounding area, as well as any site-specific information provided by the applicant, in accordance with accepted assessment protocol (SVP. 1995) to determine if there are any known paleontologic resources in the general area. If such resources are present or likely to exist, conditions of certification are applied to the project approval, which outlines procedures required during construction to mitigate any impacts.

DIRECT/INDIRECT IMPACTS AND MITIGATION

Seismicity and associated liquefaction, as well as potential differential settlement of heavily loaded structures, represent the main geologic hazards at this site. These potential hazards can be effectively mitigated through facility design. Conditions of Certification **GEN-1, GEN-5,** and **CIVIL-1** in the **Facility Design** section should mitigate these impacts to a less than significant level.

No viable geologic or mineralogic resources are known to exist in the area. Paleontological resources have been documented within 1 mile of the project site, and the native materials exhibit a high sensitivity rating with respect to containing significant paleontologic resources. Since the proposed project will include significant amounts of grading, foundation excavation, and utility trenching, staff considers the probability that paleontological resources will be encountered during such activities to be high when native materials are encountered, based on SVP assessment criteria. Conditions of Certification **PAL-1** to **PAL-7** are designed to mitigate any paleontological resource impacts, as discussed above, to a less than significant level. Potential impacts to paleontologic resources would include, but not be limited to, disturbing the natural depositional state of the resource that would prevent proper chronological inventory, in addition to damaging (i.e. crushing, cracking, and/or fragmentation) the resource itself.

GEOLOGICAL HAZARDS

The AFC (SFPUC 2005a) and site-specific geotechnical report (SFERP 2005ll) provide documentation of potential geologic hazards at the SFERP plant site, in addition to subsurface exploration information. Review of these documents, coupled with our independent research, indicates that potential geologic hazards at this site can be mitigated to less than significant as long as the proposed conditions of certification are followed.

Our independent research included review of available geologic maps, reports, and related data of the SFERP plant site. Geological information was available from the California Geological Survey (CGS), CDMG, U.S. Geological Survey (USGS), and other governmental organizations.

Faulting and Seismicity

Energy Commission staff reviewed the CGS publication *Fault Activity Map of California and Adjacent Areas with Locations and Ages of Recent Volcanic Eruptions*, dated 1994 (CGS. 1994); the *Simplified Fault Activity Map of California* (Jennings and Saucedo. 2002); the *Maps of Known Active Fault Near-Source Zones in California and Adjacent Parts of Nevada* (International Conference of Building Officials [ICBO]. 1998), the *Quaternary Geologic Map of the San Francisco Bay* (Wahrhaftig et al. 1993); the *Geologic Map of the San Francisco-San Jose Quadrangle* (Wagner et al. 1990); *Seismic Shaking Hazard Maps of California* (Petersen et al. 1999); *Probabilistic Seismic Hazard Assessment for the State of California* (CDMG. 1996a); and *Peak Acceleration from Maximum Credible Earthquakes in California (Rock and Stiff Soil Sites)* (CDMG. 1992). No active or potentially active faults are known to cross the power plant footprint or its associated linear facilities. The project is located within seismic Zone 4 as delineated on Figure 16-2 of the 2001 edition of the CBC.

The closest known active fault is the San Andreas Fault, which is located approximately 13 kilometers west of the project site. This fault is designated a class "A" fault under the CBC (a fault with a maximum magnitude earthquake greater than 7 and a slip rate in excess of 5 mm/year). The maximum moment magnitude earthquake, defined as the largest earthquake that a given fault is considered capable of generating, for the segment of San Andreas Fault closest to the project is a moment magnitude 7.9 event. The slip rate for this section of the San Andreas Fault is 24 mm/year (ICBO. 1998, Table 1). A mean peak horizontal bedrock acceleration for this fault is estimated to be 60 percent of the acceleration due to gravity (0.60g), while the peak horizontal ground surface acceleration is estimated to be 0.21g to 0.26g at the site (SFERP 2005ll). A site-specific ground surface response spectra has also been generated for this site (SFERP 2005ll). Strong ground shaking can be mitigated to less than significant through facility design as required by Condition of Certification **GEN-1**, **GEN-5**, and **CIVIL-1** in the **Facility Design** section.

Since no active faults are known to exist within the limits of the SFERP site, the potential for surface rupture at the site is considered low.

Liquefaction

Liquefaction is a condition in which a cohesionless soil loses its shear strength due to a sudden increase in pore water pressure. The soils most prone to liquefaction during earthquakes are submerged fine-grained, poorly graded, sands and silts. The *2001 Seismic Hazard Map for the City and County of San Francisco* (CDMG. 2000) and the *Preliminary Maps of Quaternary Deposits and Liquefaction Susceptibility, Nine-County San Francisco Bay Region, California* (USGS. 2000) indicates that the plant site and the proposed project linear facilities are located in a liquefaction hazard zone.

Information contained in the AFC (SFPUC 2005a) and the project geotechnical report (SFERP 2005ll) indicates that ground water is present at relatively shallow depths and that the fill present across the site exhibits a potential for liquefaction during major earthquakes. Such conditions may also exist in the proposed project linear facility areas.

Based on the above information, the site can be characterized as having a high potential for liquefaction during a large earthquake; however, this potential impact can be mitigated to less than significant through facility design as required by Conditions of Certification **GEN-1**, **GEN-5**, and **CIVIL-1** in the **Facility Design** section and following the foundation design recommendations contained in the project geotechnical report (SFERP 2005ll). Due to the heterogeneous character of the fill, potentially liquefiable soils are expected to occur as zones or pockets, rather than as horizontally or vertically continuous layers. The potential for liquefaction-induced lateral spreading within the fill is considered low due to low surface gradients at the project site, the heterogeneous nature of the fill, and the lateral confinement present immediately around the site.

Dynamic Compaction

Dynamic compaction of soils results when relatively unconsolidated granular materials experience vibration associated with seismic events. The vibration causes a decrease in soil volume, as the soil grains tend to rearrange into a more dense state (an increase in soil density). The decrease in volume can result in settlement of overlying structural improvements.

Based on the information contained in the AFC (SFPUC 2005a) and project geotechnical report (SFERP 2005ll), the potential for localized areas of dynamic compaction is considered high for the site and associated project linear facilities that pass through artificial fill materials; however, this potential impact can be mitigated to less than significant through facility design as required by Condition of Certification **GEN-1**, **GEN-5**, and **CIVIL-1** in the **Facility Design** section and by following the recommendations for foundation design as presented in the project geotechnical report (SFERP 2005ll).

Hydrocompaction

Partially saturated soils can possess bonds that are a result of chemical precipitates that accumulate under semi-arid conditions. Such soluble compound bonds provide the soils with cohesion and rigidity; however, these bonds can be destroyed upon prolonged submergence. When destroyed, a substantial decrease in the material's void ratio is experienced even though the vertical pressure does not change. Materials that exhibit this decrease in void ratio and corresponding decrease in volume with the addition of water are defined as collapsible soils. Collapsible soils are typically limited to true loess, clayey loose sands, loose sands cemented by soluble salts, and windblown silts. Since the plant site and proposed linear facilities are generally underlain by granular soils with a relatively shallow ground water table, the potential for hydrocompaction of site soils is considered low.

Subsidence

Ground subsidence is typically caused when ground water is drawn down by irrigation activities such that the effective unit weight of the soil mass is increased, which in turn increases the effective stress on the underlying soils. This results in consolidation/settlement of the underlying soils. The SFERP will obtain process water from the City of San Francisco via a new water pumping station. As such, drawdown of the water table due to SFERP operations is not anticipated. Therefore, the potential for ground subsidence is considered low.

Due to the varying thickness and density of the artificial fill that mantles the entire site, differential settlement of this material due to conventional foundation surcharge loads could be excessive. As a result, design of the heavier structures at this site will most likely require the use of ground improvement techniques or deep foundations bearing on the underlying native serpentine bedrock to minimize any differential settlement to acceptable levels.

Expansive Soils

Soil expansion occurs when clay-rich soils, with an affinity for water, exist in-place at a moisture content below their plastic limit. The addition of moisture from irrigation, capillary tension, water line breaks, etc. causes the clay soils to collect water molecules in their structure, which in turn causes an increase in the overall volume of the soil. This increase in volume can correspond to movement of overlying structural improvements. Surface materials present at the project site are expected to consist of granular fill materials overlying bedrock. Such materials are not prone to excessive expansion. Only thin, localized areas of surface clay soils would be expected. As a result, the potential for expansive soils to impact the project facilities is considered low.

Landslides

Landslides typically involve rotational slump failures within surficial soils/colluvium and/or weakened bedrock that are usually implemented by an increase of the material's moisture content above a layer, which exhibits a low strength. Debris flows are shallow landslides that travel downslope very rapidly as muddy slurry. The SFERP is relatively flat, exhibiting slopes on the order of 1 to 2 percent. As a result, the potential impact of landslides and debris flows to the SFERP is low.

Tsunamis and Seiches

Tsunamis and seiches are earthquake-induced waves, which inundate low-lying areas adjacent to large bodies of water. The proposed SFERP site is located on the east side of the San Francisco peninsula; it is not in the direct path of any potential tsunami waves. As a result, the potential for tsunamis to affect the operation of the facility is considered low.

The anticipated finish grade of the site will be approximately 15 to 20 feet above mean sea level. An earthquake on one of the local faults could generate a seiche wave in the adjacent bay, but such waves are typically less than this height. As a result, the potential for a seiche wave to impact the operation of the facility is considered low.

GEOLOGIC, MINERALOGIC, AND PALEONTOLOGIC RESOURCES

Energy Commission staff has reviewed applicable geologic maps and reports for this area (Wahrhaftig et al. 1993; Wagner et al. 1990; CDMG, 1978; California Department of Conservation. 2001; CDMG. 1990; CDMG. 1999; CGS. 2002; CDMG. 1998; CDMG. 1986; and CDMG. 1996b. Based on this review and the information contained in the AFC (SFPUC 2005a) and the project geotechnical report (SFERP 2005ll), there are no known viable geologic or mineralogic resources located at or immediately adjacent to the proposed SFERP site. The power plant footprint and the majority of the proposed linear facility routes are located in mineral resource zone (MRZ) MRZ-1, while portions of the proposed underground electrical and process water line routes are within MRZ-4. The MRZ-1 designation means that there are no known mineralogical resources, while the MRZ-4 designation indicates an area where available information is inadequate for assignment to any other MRZ zone. The only potential mineral resource in the vicinity of the project site is construction aggregate generated from the serpentine bedrock; however, this is not a viable resource since the site and surrounding area have been developed, the amount of potential aggregate would be very limited for such a small site, ground water is present at shallow depths, and the potential resource is covered by artificial fill.

A paleontologic resources field survey has not been performed for the entire project, but previous studies (SFERP 2004a; SFPUC 2005a)) in the area and a brief study of the plant site (SFERP 2005kk) have been completed. The brief study performed at the plant site (SFERP 2005kk) indicates that the younger bay mud that directly underlies the artificial fill at the site exhibits a low paleontologic sensitivity; however, the AFC (SFPUC 2005a) states that excavations deeper than the artificial fill at the SFERP plant site and trenching for pipeline or utilities burial could disturb fossiliferous sediments such that adverse impacts on significant paleontological resources could be experienced in any of the sediments and rocks present beneath the artificial fill. In addition, several documented vertebrate fossil sites are present within 1 mile of the project site.

Although the artificial fill that underlies the site and the areas proposed to host the proposed project linear routes could contain fossils since it is typically comprised of sediments from older deposits, any such fossils would lack stratigraphic context such that they would only have very limited scientific and educational value. The underlying late Pleistocene to early Holocene sediments, however, have produced numerous significant plant, invertebrate, and vertebrate fossils at previously recorded fossil sites and, as a result, have a high potential for additional similar fossils to be uncovered by excavations for project construction. The materials associated with the underlying Franciscan formation is considered to have a low potential for containing fossils only because there is the possibility that excavations could encounter blocks of fossil-bearing sedimentary rock (SFPUC 2005a).

Based on this information and staff's review of available information, the proposed SFERP site has a high potential to contain significant paleontological resources when native materials are encountered during grading, foundation, and trenching activities.

Construction Impacts and Mitigation

As noted above, no viable geologic or mineralogic resources are known to exist in the area. Paleontological resources have been documented within 1 mile of the project site, and the native materials exhibit a high sensitivity rating with respect to containing significant paleontologic resources. Since construction of the proposed project will include significant amounts of grading, foundation excavation, and utility trenching, staff considers the probability that paleontological resources will be encountered during such activities to be high when native materials are encountered, based on SVP assessment criteria. Conditions of Certification **PAL-1** to **PAL-7** are appropriate for excavation activities in native ground and are designed to mitigate any paleontological resource impacts, as discussed above, to a less than significant level. As noted previously, potential impacts to paleontologic resources would include, but not be limited to, disturbing the natural depositional state of the resource that would prevent proper chronological inventory, in addition to damaging (i.e. crushing, cracking, and/or fragmentation) the resource itself.

Operation Impacts and Mitigation

Operation of the proposed facility should not have any adverse impact on geologic, mineralogic, or paleontologic resources.

CUMULATIVE IMPACTS AND MITIGATION

With the exception of strong ground shaking and the potential liquefaction during an earthquake, as well as potential differential settlement of heavily loaded structures, the SFERP site lies in an area that generally exhibits low geologic hazards and no known viable geologic or mineralogic resources. Strong ground shaking, potential liquefaction, and potential differential settlement must be mitigated through foundation design as required by the CBC, Conditions of Certification **GEN-1**, **GEN-5**, and **CIVIL-1** in the **Facility Design** section. Paleontological resources have been documented in the general area of the project. The potential impacts to paleontological resources due to construction activities that extend into native ground will be mitigated as required by Conditions of Certification **PAL-1** to **PAL-7**.

Based on this information, it is staff's opinion that the potential for significant adverse cumulative impacts to the project from geologic hazards can be mitigated to less than significant, and that the potential for significant adverse cumulative impacts to potential geologic, mineralogic, and paleontologic resources from the proposed project, is low.

Based upon the literature and archives search, field surveys and the preliminary geotechnical investigation for the project, the applicant has proposed monitoring and mitigation measures to be followed during the construction of the power plant and associated linear facilities. Energy Commission staff agree with the applicant that the facility can be designed and constructed to minimize the effect of geologic hazards at the site, and that impacts to vertebrate fossils encountered during construction of the power plant and associated linear facilities would be mitigated to a level of insignificance.

The proposed conditions of certification are to allow the Energy Commission Compliance Project Manager (CPM) and the applicant to adopt a compliance monitoring scheme that will ensure compliance with LORS applicable to geologic hazards, and geologic, mineralogic, and paleontologic resources.

FACILITY CLOSURE

A definition and general approach to closure is presented in the General Conditions section of this assessment. Facility closure activities are not anticipated to impact geologic, mineralogic, or paleontologic resources. This is due to the fact that no such resources are known to exist at the power plant location or along its proposed linear facilities. In addition, decommissioning and closure of the power plant should not negatively affect geologic, mineralogic, or paleontologic resources since the majority of the ground disturbed in plant decommissioning and closure would have been disturbed during construction and operation of the facility.

RESPONSE TO AGENCY AND PUBLIC COMMENTS

No comments on geology and paleontology have been received for the SFERP project.

CONCLUSIONS

The applicant will likely be able to comply with applicable LORS, provided that the proposed conditions of certification are followed. The project should have no adverse impact with respect to design and construction of the project, and geologic, mineralogic, and paleontologic resources. Staff proposes to ensure compliance with applicable LORS through the adoption of the proposed conditions of certification listed below.

PROPOSED CONDITIONS OF CERTIFICATION

General conditions of certification with respect to Geology are covered under Conditions of Certification **GEN-1**, **GEN-5**, and **CIVIL-1** in the **Facility Design** section. Paleontological conditions of certification follow.

PAL-1 The project owner shall provide the Compliance Project Manager (CPM) with the resume and qualifications of its Paleontological Resource Specialist (PRS) for review and approval. If the approved PRS is replaced prior to completion of project mitigation and submittal of the Paleontological Resources Report, the project owner shall obtain CPM approval of the replacement PRS. The project owner shall submit to the CPM to keep on file resumes of the qualified Paleontological Resource Monitors (PRMs). If a PRM is replaced, the resume of the replacement PRM shall also be provided to the CPM.

The PRS resume shall include the names and phone numbers of references. The resume shall also demonstrate to the satisfaction of the CPM, the appropriate education and experience to accomplish the required paleontological resource tasks.

As determined by the CPM, the PRS shall meet the minimum qualifications for a vertebrate paleontologist as described in the Society of Vertebrate Paleontology (SVP) guidelines of 1995. The experience of the PRS shall include the following:

1. institutional affiliations, appropriate credentials and college degree,
2. ability to recognize and collect fossils in the field;
3. local geological and biostratigraphic expertise;
4. proficiency in identifying vertebrate and invertebrate fossils and;
5. at least three years of paleontological resource mitigation and field experience in California, and at least one year of experience leading paleontological resource mitigation and field activities.

The project owner shall ensure that the PRS obtains qualified paleontological resource monitors to monitor as he or she deems necessary on the project. Paleontologic resource monitors (PRMs) shall have the equivalent of the following qualifications:

- BS or BA degree in geology or paleontology and one year experience monitoring in California; or
- AS or AA in geology, paleontology or biology and four years experience monitoring in California; or
- Enrollment in upper division classes pursuing a degree in the fields of geology or paleontology and two years of monitoring experience in California.

Verification: (1) At least 60 days prior to the start of ground disturbance, the project owner shall submit a resume and statement of availability of its designated PRS for on-site work.

(2) At least 20 days prior to ground disturbance, the PRS or project owner shall provide a letter with resumes naming anticipated monitors for the project and stating that the identified monitors meet the minimum qualifications for paleontological resource monitoring required by the condition. If additional monitors are obtained during the project, the PRS shall provide additional letters and resumes to the CPM. The letter shall be provided to the CPM no later than one week prior to the monitor beginning on-site duties.

(3) Prior to the termination or release of a PRS, the project owner shall submit the resume of the proposed new PRS to the CPM for review and approval.

PAL-2 The project owner shall provide to the PRS and the CPM, for approval, maps and drawings showing the footprint of the power plant, construction laydown areas, and all related facilities. Maps shall identify all areas of the project where ground disturbance is anticipated. If the PRS requests enlargements or strip maps for linear facility routes, the project owner shall provide copies to the PRS and CPM. The site grading plan and the plan and profile drawings for the utility lines would be acceptable for this purpose. The plan drawings should show the location, depth, and extent of all ground disturbances and can be at a scale of 1 inch = 40 feet to 1 inch = 100 feet range. If the footprint of the power plant or linear facility changes, the project owner shall provide maps and drawings reflecting these changes to the PRS and CPM.

If construction of the project will proceed in phases, maps and drawings may be submitted prior to the start of each phase. A letter identifying the proposed schedule of each project phase shall be provided to the PRS and CPM. Prior to work commencing on affected phases, the project owner shall notify the PRS and CPM of any construction phase scheduling changes.

At a minimum, the project owner shall ensure that the PRS or PRM consults weekly with the project superintendent or construction field manager to confirm area(s) to be worked during the next week, until ground disturbance is completed.

Verification: (1) At least 30 days prior to the start of ground disturbance, the project owner shall provide the maps and drawings to the PRS and CPM.

(2) If there are changes to the footprint of the project, revised maps and drawings shall be provided to the PRS and CPM at least 15 days prior to the start of ground disturbance.

(3) If there are changes to the scheduling of the construction phases, the project owner shall submit a letter to the CPM within 5 days of identifying the changes.

PAL-3 The project owner shall ensure that the PRS prepares, and the project owner submits to the CPM for review and approval, a Paleontological Resources Monitoring and Mitigation Plan (PRMMP) to identify general and specific measures to minimize potential impacts to significant paleontological resources. Approval of the PRMMP by the CPM shall occur prior to any ground disturbance. The PRMMP shall function as the formal guide for monitoring, collecting and sampling activities and may be modified with CPM approval. This document shall be used as a basis for discussion in the event that on-site decisions or changes are proposed. Copies of the PRMMP shall reside with the PRS, each monitor, the project owner's on-site manager, and the CPM.

The PRMMP shall be developed in accordance with the guidelines of the Society of Vertebrate Paleontology (SVP, 1995) and shall include, but not be limited to, the following:

1. Assurance that the performance and sequence of project-related tasks, such as any literature searches, pre-construction surveys, worker environmental training, fieldwork, flagging or staking, construction monitoring, mapping and data recovery, fossil preparation and collection, identification and inventory, preparation of final reports, and transmittal of materials for curation will be performed according to the PRMMP procedures;
2. Identification of the person(s) expected to assist with each of the tasks identified within the PRMMP and the Conditions of Certification;
3. A thorough discussion of the anticipated geologic units expected to be encountered, the location and depth of the units relative to the project when known, and the known sensitivity of those units based on the occurrence of fossils either in that unit or in correlative units;
4. An explanation of why, how, and how much sampling is expected to take place and in what units. Include descriptions of different sampling procedures that shall be used for fine-grained and coarse-grained units;
5. A discussion of the locations of where the monitoring of project construction activities is deemed necessary, and a proposed plan for the monitoring and sampling;

6. A discussion of the procedures to be followed in the event of a significant fossil discovery, halting construction, resuming construction, and how notifications will be performed;
7. A discussion of equipment and supplies necessary for collection of fossil materials and any specialized equipment needed to prepare, remove, load, transport, and analyze large-sized fossils or extensive fossil deposits;
8. Procedures for inventory, preparation, and delivery for curation into a retrievable storage collection in a public repository or museum, which meets the Society of Vertebrate Paleontology standards and requirements for the curation of paleontological resources;
9. Identification of the institution that has agreed to receive any data and fossil materials collected, requirements or specifications for materials delivered for curation and how they will be met, and the name and phone number of the contact person at the institution; and
10. A copy of the paleontological Conditions of Certification.

Verification: At least 30 days prior to ground disturbance, the project owner shall provide a copy of the PRMMP to the CPM. The PRMMP shall include an affidavit of authorship by the PRS, and acceptance of the PRMMP by the project owner evidenced by a signature.

PAL-4 Prior to ground disturbance and for the duration of construction, the project owner and the PRS shall prepare and conduct weekly CPM-approved training for all recently employed project managers, construction supervisors and workers who are involved with or operate ground disturbing equipment or tools. Workers shall not excavate in sensitive units prior to receiving CPM-approved worker training. Worker training shall consist of an initial in-person PRS training during the project kick-off for those mentioned above. Following initial training, a CPM-approved video or in-person training may be used for new employees. The training program may be combined with other training programs prepared for cultural and biological resources, hazardous materials, or any other areas of interest or concern. If appropriate, multi-lingual training shall be provided for workers not fluent in English. No ground disturbance shall occur prior to CPM approval of the Worker Environmental Awareness Program (WEAP), unless specifically approved by the CPM.

The WEAP shall address the potential to encounter paleontological resources in the field, the sensitivity and importance of these resources, and the legal obligations to preserve and protect such resources.

The training shall include:

1. A discussion of applicable laws and penalties under the law;
2. Good quality photographs or physical examples of vertebrate fossils shall be provided for project sites containing units of high paleontologic sensitivity;

3. Information that the PRS or PRM has the authority to halt or redirect construction in the event of a discovery or unanticipated impact to a paleontological resource;
4. Instruction that employees are to halt or redirect work in the vicinity of a find and to contact their supervisor and the PRS or PRM;
5. An informational brochure that identifies reporting procedures in the event of a discovery;
6. A Certification of Completion of WEAP form signed by each worker indicating that they have received the training; and
7. A sticker that shall be placed on hard hats indicating that environmental training has been completed.

<u>Verification:</u> (1) At least 30 days prior to ground disturbance, the project owner shall submit the proposed WEAP including the brochure with the set of reporting procedures the workers are to follow.

(2) At least 30 days prior to ground disturbance, the project owner shall submit the script and final video to the CPM for approval if the project owner is planning on using a video for interim training.

(3) If the owner requests an alternate paleontological trainer, the resume and qualifications of the trainer shall be submitted to the CPM for review and approval prior to installation of an alternate trainer. Alternate trainers shall not conduct training prior to CPM authorization.

(4) In the Monthly Compliance Report (MCR) the project owner shall provide copies of the WEAP Certification of Completion forms with the names of those trained and the trainer or type of training (in-person or video) offered that month. The MCR shall also include a running total of all persons who have completed the training to date.

PAL-5 The project owner shall ensure that the PRS and PRM(s) monitor consistent with the PRMMP all construction-related grading, excavation, trenching, and augering in areas where potentially fossil-bearing materials have been identified, both at the site and along any constructed linear facilities associated with the project. In the event that the PRS determines full time monitoring is not necessary in locations that were identified as potentially fossil-bearing in the PRMMP, the project owner shall notify and seek the concurrence of the CPM.

The project owner shall ensure that the PRS and PRM(s) have the authority to halt or redirect construction if paleontological resources are encountered. The project owner shall ensure that there is no interference with monitoring activities unless directed by the PRS. Monitoring activities shall be conducted as follows:

1. Any change of monitoring different from the accepted schedule presented in the PRMMP shall be proposed in a letter or email from the PRS and the project owner to the CPM prior to the change in monitoring and included in

the Monthly Compliance Report. The letter or email shall include the justification for the change in monitoring and be submitted to the CPM for review and approval.

2. The project owner shall ensure that the PRM(s) keeps a daily log of monitoring of paleontological resource activities. The PRS may informally discuss paleontological resource monitoring and mitigation activities with the CPM at any time.
3. The project owner shall ensure that the PRS immediately notifies the CPM within 24 hours of the occurrence of any incidents of non-compliance with any paleontological resources Conditions of Certification. The PRS shall recommend corrective action to resolve the issues or achieve compliance with the Conditions of Certification.
4. For any significant paleontological resources encountered, either the project owner or the PRS shall notify the CPM within 24 hours or Monday morning in the case of a weekend when construction has been halted due to a paleontological find.

The project owner shall ensure that the PRS prepares a summary of the monitoring and other paleontological activities that will be placed in the Monthly Compliance Reports (MCR). The summary will include the name(s) of PRS or PRM(s) active during the month, general descriptions of training and monitored construction activities and general locations of excavations, grading, etc. A section of the report shall include the geologic units or subunits encountered; descriptions of sampling within each unit; and a list of identified fossils. A final section of the report will address any issues or concerns about the project relating to paleontologic monitoring including any incidents of non-compliance and any changes to the monitoring plan that have been approved by the CPM. If no monitoring took place during the month, the report shall include an explanation in the summary as to why monitoring was not conducted.

Verification: The project owner shall ensure that the PRS submits the summary of monitoring and paleontological activities in the MCR. When feasible, the CPM shall be notified 10 days in advance of any proposed changes in monitoring different from the plan identified in the PRMMP. If there is any unforeseen change in monitoring, the notice shall be given as soon as possible prior to implementation of the change.

PAL-6 The project owner, through the designated PRS, shall ensure that all components of the PRMMP are adequately performed including collection of fossil materials, preparation of fossil materials for analysis, analysis of fossils, identification and inventory of fossils, the preparation of fossils for curation, and the delivery for curation of all significant paleontological resource materials encountered and collected during the project construction.

Verification: The project owner shall maintain in their compliance file copies of signed contracts or agreements with the designated PRS and other qualified research specialists. The project owner shall maintain these files for a period of three years after completion and approval of the CPM-approved Paleontological Resource Report (See **PAL-7**). The project owner shall be responsible to pay any curation fees charged by the museum for fossils collected and curated as a result of paleontological mitigation. A copy of the letter of transmittal submitting the fossils to the curating institution shall be provided to the CPM.

PAL-7 The project owner shall ensure preparation of a Paleontological Resources Report (PRR) by the designated PRS. The PRR shall be prepared following completion of the ground disturbing activities. The PRR shall include an analysis of the collected fossil materials and related information and submitted to the CPM for review and approval.

The report shall include, but is not limited to, a description and inventory of recovered fossil materials; a map showing the location of paleontological resources encountered; determinations of sensitivity and significance; and a statement by the PRS that project impacts to paleontological resources have been mitigated below the level of significance.

<u>**Verification:**</u> Within 90 days after completion of ground disturbing activities, including landscaping, the project owner shall submit the Paleontological Resources Report under confidential cover to the CPM.

Certification of Completion
Worker Environmental Awareness Program
San Francisco Reliability Project (Docket #04-AFC-1)

This is to certify these individuals have completed a mandatory California Energy Commission-approved Worker Environmental Awareness Program (WEAP). The WEAP includes pertinent information on Cultural, Paleontology and Biological Resources for all personnel (i.e., construction supervisors, crews and plant operators) working on-site or at related facilities. By signing below, the participant indicates that they understand and shall abide by the guidelines set forth in the Program materials. Include this completed form in the Monthly Compliance Report.

No.	Employee Name	Title/Company	Signature
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
21.			
22.			
23.			
24.			
25.			

Cultural Trainer: ______________ Signature:____________________Date: ___/___/____

Paleo Trainer: _______________ Signature:_____________________Date: ___/___/____

Biological Trainer: ________________ Signature:________________Date: ___/___/__

REFERENCES

CBC (California Building Code). 2001.

California Code of Regulations, Title 24 (*California Building Standards Code* [CBSC]), Part 2, *California Building Code* (CBC). 2001.

California Code of Regulations, Title 14 (*California Environmental Quality Act [CEQA),* Guidelines, amended September 7, 2004.

CDC (California Department of Conservation). 2001. *Oil, Gas, and Geothermal Fields in California.*

CDMG (California Department of Conservation, Division of Mines and Geology). 1978. *Limestone, Dolomite, and Shell Resources of the Coast Ranges Province*, California, Bulletin 197.

CDMG. 1986. Mineral Land Classification: Aggregate Materials in the San Francisco – Monterey Bay Area, Special Report 146, Part I.

CDMG. 1990. Industrial Minerals in California: Economic Importance, Present Availability, and Future Development, Special Publication 105, Reprinted from U.S. Geological Survey Bulletin 1958.

CDMG. 1992. *Peak Acceleration from Maximum Credible Earthquakes in California (Rock and Stiff-Soil Sites)* (Prepared for Internal Use by Caltrans), DMG Open-File Report 92-1.

CDMG. 1994. *Fault Activity Map of California and Adjacent Areas with Locations and Ages of Recent Volcanic Eruptions, Scale: 1:750,000.*

CDMG. 1996a. *Probabilistic Seismic Hazard Assessment for the State of California*, DMG Open-File Report 96-08, USGS Open-File Report 96-706.

CDMG. 1996b. *Update of Mineral Land Classification: Aggregate Materials in the South San Francisco Bay Production-Consumption Region*, DMG Open-File Report 96-03.

CDMG. 1998. *Gold Districts of California*, Sesquicentennial Edition, California Gold Discovery to Statehood, Bulletin 193.

CDMG. 1999. *Mines and Mineral Producers Active in California (1997-1998)*, Special Publication 103.

CDMG. 2000. *2001 Seismic Hazard Map for the City and County of San Francisco.*

CGS (California Geological Survey - Formerly the California Division of Mines and Geology). 1994. *Fault Activity Map of California and Adjacent Areas with Locations and Ages of Recent Volcanic Eruptions*, Scale: 1:750,000.

CGS. 2002. *Aggregate Availability in California*, Map Sheet 52.

ICBO (International Conference of Building Officials). 1998. *Map of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada.*

Jennings, Charles W., and George J. Saucedo. 2002. *Simplified Fault Activity Map of California, Map Sheet 54*. California Geological Survey.

Mace, Neil. 2002. *Final Staff Assessment for Potrero Power Plant Unit 7 Project (Geology and Paleontology).*

Norris, R. M. and R. W. Webb. 1990. *Geology of California*. Second Edition. John Wiley and Sons. New York.

Petersen, M., Beeby, D., Bryant, W., Cao, C., Cramer, C., Davis, J., Reichle, M., Saucedo, G., Tan, S., Taylor, G., Toppozada, T., Treiman, J., Wills, C. 1999. *Seismic Shaking Hazard Maps of California, Map Sheet 48*. California Division of Mines and Geology.

SFERP 2004a – City and County of San Francisco/Blout. *Application for Certification* San Francisco Electric Reliability Project – 145-megawatt natural gas-fired peaking power plant located in San Francisco. Submitted to CEC/Therkelsen/Dockets on 3/18/04.

SFERP 2005c – San Francisco Electric Reliability Project. Final Geotechnical Study Report. Submitted to CED/Pfanner/Dockets on 3/25/05.

SFERP 2005kk – CH2MHill/Carrier. Data Response Set 3E & Sarvey Response Set 1B. 10/06/2005. Rec'd 10/07/2005.

SFERP 2005ll – CH2MHill/Carrier. Informal Data Response, Set 8 (194 pgs). 10/07/2005. Rec'd 10/07/2005.

SFPUC 2005a – San Francisco Public Utilities Commission/Hale. Amendment A of the Application for Certification. Submitted to CEC/Therkelsen/Dockets on 3/25/05.

SVP (Society for Vertebrate Paleontology). 1995. *Measures for Assessment and Mitigation of Adverse Impacts to Non-Renewable Paleontologic Resources: Standard Procedures.*

USGS (U.S. Geological Survey). 2000. *Preliminary Maps of Quaternary Deposits and Liquefaction Susceptibility, Nine-County San Francisco Bay Region, California*.

Wagner, D.L., E. J. Bortugno, and R.D. McJunkin. 1990. *Geologic Map of the San Francisco-San Jose Quadrangle*, California Division of Mines and Geology.

Wahrhaftig, Clyde, Scott W. Stine, and N. King Huber. 1993. *Quaternary Geologic Map of the San Francisco Bay 4° x 6° Quadrangle, United States*.

POWER PLANT EFFICIENCY

Testimony of Steve Baker

SUMMARY OF CONCLUSIONS

The project, if constructed and operated as proposed, would generate a nominal 145 MW of peaking electric power, at an overall project fuel efficiency of 36 percent lower heating value (LHV) at maximum full load. While it will consume substantial amounts of energy, it will do so in the most efficient manner practicable. It will not create significant adverse effects on energy supplies or resources, will not require additional sources of energy supply, and will not consume energy in a wasteful or inefficient manner. No energy standards apply to the project. Staff therefore concludes that the project would present no significant adverse impacts upon energy resources.

INTRODUCTION

The Energy Commission makes findings as to whether energy use by the San Francisco Electric Reliability Project (SFERP) will result in significant adverse impacts on the environment, as defined in the California Environmental Quality Act (CEQA). If the Energy Commission finds that the SFERP's consumption of energy would create a significant adverse impact, it must determine whether there are any feasible mitigation measures that could eliminate or minimize the impacts. In this analysis, staff addresses the issue of inefficient and unnecessary consumption of energy.

In order to support the Energy Commission's findings, this analysis will:

- examine whether the facility will likely present any adverse impacts upon energy resources;
- examine whether these adverse impacts are significant; and if so,
- examine whether feasible mitigation measures exist that would eliminate the adverse impacts, or reduce them to a level of insignificance.

LAWS, ORDINANCES, REGULATIONS AND STANDARDS

No Federal, State or local/county laws, ordinances, regulations and standards (LORS) apply to the efficiency of this project.

SETTING

The City and County of San Francisco (CCSF) proposes to construct and operate the 145 MW (nominal net output) simple cycle SFERP, providing peaking power to the Pacific Gas and Electric (PG&E) power grid system in San Francisco and the peninsula (SFPUC 2005a, AFC §§ 1.2, 1.9.4, 3.4.3, 10.3.2). (Note that this nominal rating is based upon preliminary design information and generating equipment manufacturers' guarantees. The project's actual maximum generating capacity may differ from this figure.) SFERP has executed a Power Purchase Agreement (PPA) with the California

Department of Water Resources (CDWR) that requires SFERP to sell the power from the four GE LM6000 SPRINT combustion turbine generators (CTG), received as part of a settlement with Williams Energy Marketing and Trading Company, to the CDWR (SFPUC 2005a, AFC § 1.1). This Staff Assessment will only evaluate the three-turbine project described in CCSF's Application for Certification (AFC). The applicant intends for SFERP to operate up to a total of 12,000 engine hours per year for the three combustion turbines. This is equivalent to each of the three turbines operating approximately 46 percent of the year (SFPUC 2005a, AFC § 2.4.1). Each CTG will utilize an electric water chiller at its inlet to maintain output and efficiency during periods of high ambient temperatures (SFPUC 2005a, AFC §§ 2.2.2, 2.2.3, 2.2.4). Natural gas will be transmitted to the plant via a new 900-foot section of 12-inch diameter (or less) pipeline connected to a booster compressor station that will be part of the SFERP facility (SFPUC 2005a, AFC §§ 1.2, 2.1, 6.1, 6.2).

ASSESSMENT OF IMPACTS

METHOD AND THRESHOLD FOR DETERMINING SIGNIFICANCE OF ENERGY RESOURCES

CEQA Guidelines state that the environmental analysis "…shall describe feasible measures which could minimize significant adverse impacts, including where relevant, inefficient and unnecessary consumption of energy" (Cal. Code Regs., tit. 14, § 15126.4(a)(1)). Appendix F of the Guidelines further suggests consideration of such factors as the project's energy requirements and energy use efficiency; its effects on local and regional energy supplies and energy resources; its requirements for additional energy supply capacity; its compliance with existing energy standards; and any alternatives that could reduce wasteful, inefficient and unnecessary consumption of energy (Cal. Code regs., tit. 14, § 15000 et seq., Appendix F).

The inefficient and unnecessary consumption of energy, in the form of non-renewable fuels such as natural gas and oil, constitutes an adverse environmental impact. An adverse impact can be considered significant if it results in:

- adverse effects on local and regional energy supplies and energy resources;
- a requirement for additional energy supply capacity;
- noncompliance with existing energy standards; or
- the wasteful, inefficient and unnecessary consumption of fuel or energy.

PROJECT ENERGY REQUIREMENTS AND ENERGY USE EFFICIENCY

Any power plant large enough to fall under Energy Commission siting jurisdiction will consume large amounts of energy. Under average ambient conditions, the SFERP would burn natural gas at a nominal rate of 31,667 million Btu per day LHV (SFPUC 2005a, AFC § 2.2.6). This is a substantial rate of energy consumption, and holds the potential to impact energy supplies. Under expected project conditions, electricity will be generated at a full load efficiency of approximately 36 percent LHV with the combustion turbines operating at full load (SFPUC 2005a, AFC § 10.4, Fig. 2-4a, Fig. 2-4b, Fig. 2-4c).

ADVERSE EFFECTS ON ENERGY SUPPLIES AND RESOURCES

The applicant has described its sources of supply of natural gas for the project (SFPUC 2005a, AFC §§ 1.2, 2.1, 2.2.6, 6.0, 10.2.1). Natural gas for the SFERP will be supplied from the existing PG&E natural gas transmission pipeline located adjacent to the project site. The PG&E natural gas system has access to gas from the Rocky Mountains, Canada and the Southwest. This represents a resource of considerable capacity. Furthermore, the PG&E gas supply represents an adequate source for a project of this size. It is therefore highly unlikely that the project could pose a significant adverse impact on natural gas supplies in California.

ADDITIONAL ENERGY SUPPLY REQUIREMENTS

Natural gas fuel will be supplied to the project by PG&E transmission pipeline 101 via a new 12-inch diameter pipeline constructed from the PG&E tap point to the SFERP site(SFPUC 2005a, AFC §§ 1.2, 2.1, 2.2.6, 6.0, 6.1, Appendix 6). A letter from PG&E dated August 13, 2004 confirms the ability and willingness of PG&E to provide the necessary quantities of natural gas to the SFERP (PG&E 2004a). This is a resource with adequate delivery capacity for a project of this size. There is no real likelihood that the SFERP will require the development of additional energy supply capacity.

COMPLIANCE WITH ENERGY STANDARDS

No standards apply to the efficiency of the SFERP or other non-cogeneration projects.

ALTERNATIVES TO REDUCE WASTEFUL, INEFFICIENT AND UNNECESSARY ENERGY CONSUMPTION

The SFERP could be deemed to create significant adverse impacts on energy resources if alternatives existed that would reduce the project's use of fuel. Evaluation of alternatives to the project that could reduce wasteful, inefficient or unnecessary energy consumption first requires examination of the project's energy consumption. Project fuel efficiency, and therefore its rate of energy consumption, is determined by the configuration of the power producing system and by the selection of equipment used to generate power.

Project Configuration

The project objective is to reduce the need for existing unreliable and highly-polluting in-City generation while maintaining the reliability of the electric system (SFPUC 2005a, AFC §§ 1.1, 1.2.1, 3.0). It is the City's expectation that the SFERP will mostly operate to provide local reliability service. A simple-cycle configuration is consistent with and supports this expectation since the units will not be competitive with base load facilities (SFERP 2005n, Data Response 179). The SFERP will be configured as three simple cycle power plants in parallel, in which electricity is generated by three natural gas-fired turbine generators (SFPUC 2005a, AFC §§ 1.1, 1.2, 2.2.2, 2.2.4). This configuration, with its short start-up time and fast ramping[1] capability, is well suited to providing peaking power. Further, when reduced output is required, one or two turbine generators

[1] Ramping is increasing and decreasing electrical output to meet fluctuating load requirements.

can be shut down, allowing the remaining machine(s) to produce a percentage of the full power at optimum efficiency, rather than operating a single, larger machine at an inefficient part load output.

The applicant intends for this facility to operate in peaking duty up to a total of 12,000 engine hours per year for the three combustion turbines. This is equivalent to each of the three turbines operating approximately 46 percent of the year (SFPUC 2005a, AFC § 2.4.1).

Equipment Selection

Modern gas turbines embody the most fuel-efficient electric generating technology available today. The applicant will employ three General Electric LM6000 SPRINT gas turbine generators (SFPUC 2005a, AFC §§ 1.1, 1.2, 2.2.2, 2.2.4). The LM6000 SPRINT gas turbine to be employed in the SFERP represents one of the most modern and efficient such machines now available. The SPRINT version of this machine is nominally rated at 50 MW and 40.3 percent efficiency LHV at ISO[2] conditions (GTW 2004). This rating differs from SFERP's projected efficiency of 36 percent LHV because of the efficiency losses from parasitic loads (mechanical inlet air chillers) and the reduced system efficiency from the selective catalytic reduction units used on the exhaust of each unit.

Efficiency Of Alternatives To The Project

Alternative Generating Technologies

Alternative generating technologies for the SFERP are considered in the AFC (SFPUC 2005a, AFC § 9.7). Fossil fuels (oil and coal), biomass, geothermal, solar, hydroelectric, wind, and nuclear technologies are all considered. Biomass and fossil fuels other than natural gas cannot meet air quality limitations. Renewables require more physical area and are not always available when peaking power is needed. Given the project objectives, location, and air pollution control requirements, staff agrees with the applicant that only natural gas-burning technologies are feasible.

Natural Gas-Burning Technologies

Fuel consumption is one of the most important economic factors in selecting an electric generator; fuel typically accounts for over two-thirds of the total operating costs of a fossil-fired power plant (Power 1994). Under a competitive power market system, where operating costs are critical in determining the competitiveness and profitability of a power plant, the plant owner is thus strongly motivated to purchase fuel-efficient machinery.

Capital cost is also important in selecting generating machinery. Recent progress in the development of gas turbines, incorporating technological advances made in the development of aircraft (jet) engines, combined with the cost advantages of assembly-line manufacturing, has made available machines that not only offer the lowest available fuel costs, but at the same time sell for the lowest per-kilowatt capital cost.

[2] International Standards Organization (ISO) standard conditions are 15°C (59°F), 60 percent relative humidity, and one atmosphere of pressure (equivalent to sea level).

The applicant will employ three General Electric LM6000PC SPRINT gas turbine generators (SFPUC 2005a, AFC §§ 1.1, 1.2, 2.2.2, 2.2.4). The LM6000PC SPRINT gas turbine to be employed in the SFERP represents one of the most modern and efficient such machines now available. The SPRINT version of this machine is nominally rated at 50 MW and 40.5 percent efficiency LHV at ISO[3] conditions (GTW 2004). (Staff compares alternative machines' ISO ratings as a common baseline, since project-specific ratings are not available for the alternative machines.) Alternative machines that can meet the project's objectives are the SGT-800 and FT8 TwinPac which, like the LM6000, are aeroderivative machines, adapted from Siemens Power Generation and Pratt & Whitney aircraft engines, respectively.

The Siemens SGT-800 gas turbine generator in a simple cycle configuration is nominally rated at 45 MW and 37 percent LHV at ISO conditions (GTW 2004).

Another alternative is the Pratt & Whitney FT8 TwinPac gas turbine generator in a simple cycle configuration that is nominally rated at 51 MW and 38.4 percent LHV at ISO conditions (GTW 2004).

Machine	Generating Capacity (MW)	ISO Efficiency (LHV)
GE LM6000PC SPRINT	**50**	**40.5 %**
SIEMENS	45	37.0 %
P & W FT8 TwinPac	51	38.4 %

Source: GTW 2004

The LM6000PC SPRINT is further enhanced by the incorporation of spray intercooling (thus the name, SPRay INTercooling). This takes advantage of the aeroderivative machine's two-stage compressor.[4] By spraying water into the airstream between the two compressor stages, the partially compressed air is cooled, reducing the amount of work that must be performed by the second stage compressor. This reduces the power consumed by the compressor, yielding greater net power output and higher fuel efficiency. The benefits in generating capacity and fuel efficiency increase with rising ambient air temperatures (GTW 2000).

While the LM6000 enjoys a slight advantage in fuel efficiency over the alternative machines, any differences among the three in actual operating efficiency will be relatively insignificant. Other factors such as generating capacity, cost, and ability to meet air pollution limitations are some of the factors considered in selecting the turbine model.

[3] International Standards Organization (ISO) standard conditions are 15°C (59°F), 60 percent relative humidity, and one atmosphere of pressure (equivalent to sea level).

[4] The larger industrial type gas turbines typically are single-shaft machines, with single-stage compressor and turbine. Aeroderivatives are two-shaft (or, in some cases, three-shaft) machines, with two-stage (or three-stage) compressors and turbines.

Inlet Air Cooling

A further choice of alternatives involves the selection of gas turbine inlet air-cooling methods.[5] The two commonly used techniques are the evaporative cooler or fogger, and the chiller (mechanical or absorption); both techniques increase power output by cooling the gas turbine inlet air. In general terms, a mechanical chiller can offer greater power output than the evaporative cooler on hot, humid days, but consumes electric power to operate its refrigeration process, thus slightly reducing overall net power output and, thus, overall efficiency. An absorption chiller uses less electric power, but necessitates the use of a substantial inventory of ammonia. An evaporative cooler or a fogger boosts power output best on dry days; it uses less electric power than a mechanical chiller, possibly yielding slightly higher operating efficiency. The difference in efficiency among these techniques is relatively insignificant.

The applicant proposes to employ inlet air mechanical chillers (SFPUC 2005a, AFC §§ 2.2.2, 2.2.4, 2.2.8). Given the relative lack of clear superiority of one system over the other, staff agrees that the applicant's approach will yield no significant adverse energy impacts.

In conclusion, the project configuration (simple cycle) and generating equipment chosen appear to represent the most efficient feasible combination to satisfy the project objectives. There are no alternatives that could significantly reduce energy consumption.

CUMULATIVE IMPACTS

Potrero Unit 3 and Hunters Point Unit 4 are nearby operating power plant projects that hold the potential for cumulative energy consumption impacts when aggregated with the project. A letter from PG&E dated August 13, 2004 confirms the ability and willingness of PG&E to provide the necessary quantities of natural gas to the SFERP with the Hunters Point and Potrero Unit 3 Power Plants on-line.

CCSF's proposed peaker plant (fourth turbine) at the San Francisco International airport will have a minimal impact on the natural gas supply of the San Francisco Bay Area. Staff knows of no other projects that could result in cumulative energy impacts.

Staff believes that construction and operation of the project will not bring about indirect impacts, in the form of additional fuel consumption, that would not have occurred but for the project. The older, less efficient power plants consume more natural gas to operate than the new, more efficient plants such as the SFERP (CEC 2004rr). The high efficiency of the proposed SFERP should allow it to compete very favorably, running at a high capacity factor, replacing less efficient power generating plants, and therefore not having an impact or even reducing the cumulative amount of natural gas consumed for power generation.

[5] A gas turbine's power output decreases as ambient air temperatures rise. The LM6000 SPRINT produces peak power at 50°F; this peak output can be maintained in much hotter weather by cooling the inlet air.

NOTEWORTHY PROJECT BENEFITS

The applicant states that the SFERP complements City efforts to develop energy efficiency improvements, renewable resources, and clean distributed generation. The City meets its objectives for developing improvements in energy efficiency with the proposed use of the GE LM6000 SPRINT gas turbines for the SFERP. The GE LM6000 SPRINT gas turbines represent one of the most modern and efficient such machines now available. The SFERP will represent an efficient replacement for existing in-City generation.

The configuration of the SFERP, as three simple cycle power plants in parallel, allows for one or two turbine generators to be shut down, with the remaining machine(s) still producing a percentage of the full power at optimum efficiency, rather than operating a single, larger machine at an inefficient part load output.

RESPONSE TO AGENCY AND PUBLIC COMMENTS

Staff has received no comments in the area of Efficiency.

CONCLUSIONS

The project, if constructed and operated as proposed, would generate a nominal 145 MW of peaking electric power, at an overall project fuel efficiency of 36 percent LHV at maximum full load. While it will consume substantial amounts of energy, it will do so in the most efficient manner practicable. It will not create significant adverse effects on energy supplies or resources, will not require additional sources of energy supply, and will not consume energy in a wasteful or inefficient manner. No energy standards apply to the project. Staff therefore concludes that the project would present no significant adverse impacts upon energy resources. No cumulative impacts on energy resources are likely.

PROPOSED CONDITIONS OF CERTIFICATION

No Conditions of Certification are proposed.

REFERENCES

CEC 2004 rr – California Energy Commission. Integrated Energy Policy Report 2004 Update, “Reliability Concerns with Aging Power Plants”, page 5. Publication # 100-02-004CM. Submitted to CEC/Dockets on 12/13/2004.

GTW (Gas Turbine World). 2004. *Gas Turbine World, Volume 24 (the 2004-05 GTW Handbook), pp. 71, 76-77.*

GTW (Gas Turbine World). 2000. ”LM6000 SPRINT design enhanced to increase power and efficiency”, *Gas Turbine World*, July-August 2000, pp. 16-19.

PG&E 2004a – Pacific Gas & Electric Company/Boschee. Letter to confirm that PG&E does have capacity to serve the gas load with power plants on line. Submitted to Hetch Hetchy Water & Power/Hollenbacher/CEC/Dockets on 8/13/04.

Power (Power Magazine). 1994. “Operating and maintaining IPP/cogen facilities,” Power, September 1994, p. 14.

SFERP 2005n — CH2MHill/Carrier. Data Response Set 3A. Submitted to CEC/Pfanner/Dockets on 6/3/05.

SFPUC2005a — San Francisco Public Utilities Commission/Hale. Amendment A of the Application for Certification. Submitted to CEC/Therkelsen/Dockets on 3/25/05.

POWER PLANT RELIABILITY

Testimony of Steve Baker

SUMMARY OF CONCLUSIONS

The City and County of San Francisco predicts an equivalent availability factor of 94 to 98 percent, which staff believes is achievable. Based on a review of the proposal, staff concludes that the plant will be built and operated in a manner consistent with industry norms for reliable operation. This should provide an adequate level of reliability. No conditions of certification are proposed.

INTRODUCTION

In this analysis, Energy Commission staff addresses the reliability issues of the project to determine if the power plant is likely to be built in accordance with typical industry norms for reliability of power generation. Staff uses this level of reliability as a benchmark because it ensures that the resulting project would likely not degrade the overall reliability of the electric system it serves (see **Setting** below).

The scope of this power plant reliability analysis covers:

- equipment availability;
- plant maintainability;
- fuel and water availability; and
- power plant reliability in relation to natural hazards.

Staff examined the project design criteria to determine if the project is likely to be built in accordance with typical industry norms for reliability of power generation. While the City and County of San Francisco (CCSF) has predicted an equivalent availability factor approaching 94 to 98 percent for the San Francisco Electric Reliability Project (SFERP) (see below), staff uses typical industry norms as a benchmark, rather than CCSF's projection, to evaluate the project's reliability.

LAWS, ORDINANCES, REGULATIONS AND STANDARDS

No Federal, State or local/county laws, ordinances, regulations and standards (LORS) apply to the reliability of this project.

SETTING

In the restructured competitive electric power industry, the responsibility for maintaining system reliability falls largely to the State's control area operators, such as the California Independent System Operator (Cal-ISO), that purchase, dispatch, and sell electric power throughout the State. How the Cal-ISO and other control area operators will ensure system reliability is still being determined; protocols are being developed and put in place that will, it is anticipated, allow sufficient reliability to be maintained under the competitive market system. "Must-run" power purchase agreements and "participating generator" agreements are two mechanisms being employed to ensure an adequate supply of reliable power.

The Cal-ISO also requires those power plants selling ancillary services, as well as those holding reliability must-run contracts, to fulfill certain requirements, including:

- filing periodic reports on plant reliability;
- reporting all outages and their causes; and
- scheduling all planned maintenance outages with the Cal-ISO.

The Cal-ISO's mechanisms to ensure adequate power plant reliability apparently have been devised under the assumption that the individual power plants that compete to sell power into the system will each exhibit a level of reliability similar to that of power plants of past decades. However, there is cause to believe that, under free market competition, financial pressures on power plant owners to minimize capital outlays and maintenance expenditures may act to reduce the reliability of many power plants, both existing and newly constructed (McGraw-Hill 1994). It is possible that, if significant numbers of power plants exhibit individual reliability sufficiently lower than this historical level, the assumptions used by Cal-ISO to ensure system reliability will prove invalid, with potentially disappointing results. Until the restructured competitive electric power system has undergone a shakeout period, and the effects of varying power plant reliability are thoroughly understood and compensated for, staff will recommend that power plant owners continue to build and operate their projects to the level of reliability to which all in the industry are accustomed.

As part of its plan to provide needed reliability, the applicant proposes to operate the 145 MW (nominal output) SFERP, a simple-cycle peaking power plant, providing power to the San Francisco peninsula customers (SFPUC 2005a, AFC §§ 1.2, 1.9.4, 3.4.3, 10.3.2). The project estimates an Equivalent Availability Factor (EAF) in the range of 94 to 98 percent, and is designed to operate between approximately 15 and 100 percent of base load (Note: that Air Quality emission requirements will limit the total annual fuel used by all 3 combustion turbine generators to 12,000 hours per year for the facility). The combustion turbine generator power block is also projected to operate between 15 and 100 percent of the time, if required, during each year of its operating life (SFPUC 2005a, AFC § 10.3.2).

ASSESSMENT OF IMPACTS

METHOD FOR DETERMINING RELIABILITY

The Commission must make findings as to the manner in which the project is to be designed, sited and operated to ensure safe and reliable operation [Cal. Code Regs., tit. 20, § 1752(c)]. Staff takes the approach that a project is acceptable if it does not degrade the reliability of the utility system to which it is connected. This is likely the case if the project exhibits reliability at least equal to that of other power plants on that system.

The availability factor for a power plant is the percentage of the time that it is available to generate power; both planned and unplanned outages subtract from its availability. Measures of power plant reliability are based on its actual ability to generate power when it is considered available and are based on starting failures and unplanned, or forced, outages. For practical purposes, reliability can be considered a combination of these two industry measures, making a reliable power plant one that is available when called upon to operate. Throughout its intended 30-year life (SFPUC 2005a, AFC § 10.3.2), the SFERP will be expected to perform reliably. Power plant systems must be able to operate for extended periods without shutting down for maintenance or repairs. Achieving this reliability is accomplished by ensuring adequate levels of equipment availability, plant maintainability with scheduled maintenance outages, fuel and water availability, and resistance to natural hazards. Staff examines these factors for the project and compares them to industry norms. If they compare favorably, staff can conclude that the SFERP will be as reliable as other power plants on the electric system, and will therefore not degrade system reliability.

EQUIPMENT AVAILABILITY

Equipment availability will be ensured by use of appropriate quality assurance/quality control (QA/QC) programs during design, procurement, construction and operation of the plant, and by providing for adequate maintenance and repair of the equipment and systems (discussed below).

Quality Control Program

The applicant describes a QA/QC program (SFPUC 2005a, AFC §§ 2.4.5, 2.4.5.2) typical of the power industry. Equipment will be purchased from qualified suppliers, based on technical and commercial evaluations. Suppliers' personnel, production capability, past performance, QA programs and quality history will be evaluated. The project owner will perform receipt inspections, test components, and administer independent testing contracts. Staff expects implementation of this program to yield typical reliability of design and construction. To ensure such implementation, staff has proposed appropriate conditions of certification under the portion of this document entitled **Facility Design**.

PLANT MAINTAINABILITY

Equipment Redundancy

A generating facility called on to operate for long periods of time must be capable of being maintained while operating. A typical approach for achieving this is to provide redundant examples of those pieces of equipment most likely to require service or repair.

The applicant plans to provide appropriate redundancy of function for the project (SFPUC 2005a, AFC § 2.4.2). The fact that the project consists of three combustion turbine-generators configured as independent equipment trains provides inherent reliability. A single equipment failure cannot disable more than one train, thus allowing the plant to continue to generate (at reduced output). Further, all plant ancillary systems are also designed with adequate redundancy, and 100% backup of station service and auxiliary transformers. The natural gas fuel supply line interconnects with Pacific Gas and Electric's (PG&E) natural gas transmission system at a natural gas pipeline header. This enables the project to be supplied by any one of three natural gas pipelines. In addition, four 33% capacity natural gas booster compressors are provided to insure an adequate fuel supply (SFERP 2004g).

With this opportunity for continued operation in the face of equipment failure, staff believes that equipment redundancy will be sufficient for a project such as this.

Maintenance Program

The applicant proposes to establish a preventive plant maintenance program typical of the industry (SFPUC 2005a, AFC § 2.4.5.2). Equipment manufacturers provide maintenance recommendations with their products; the applicant will base its maintenance program on these recommendations. The program will encompass preventive and predictive maintenance techniques. Maintenance outages will be planned for periods of low electricity demand. In light of these plans, staff expects that the project will be adequately maintained to ensure acceptable reliability.

FUEL AND WATER AVAILABILITY

For any power plant, the long-term availability of fuel and of water for cooling or process use is necessary to ensure reliability. The need for reliable sources of fuel and water is obvious; lacking long-term availability of either source, the service life of the plant may be curtailed, threatening the supply of power as well as the economic viability of the plant.

Fuel Availability

The SFERP will burn natural gas from the PG&E distribution system. Natural gas fuel will be supplied to the project by PG&E transmission pipeline 101 via a new 12-inch diameter pipeline constructed from the PG&E tap point to the SFERP site. PG&E transmission pipeline 101 is one of three supply lines to PG&E's San Francisco Load Center located adjacent to PG&E's Potrero Substation. The San Francisco Load Center is supplied by three natural gas lines (101, 109, and 132), which will provide the SFERP facility with a reliable source of natural gas (SFPUC 2005a, AFC §§ 1.2, 2.1, 6.0, 6.1, 10.3.1). This PG&E natural gas system represents a resource of considerable capacity and offers access to adequate supplies of gas. A letter from PG&E dated August 13, 2004 confirms the ability and willingness of PG&E to provide the necessary quantities of natural gas to the SFERP (PG&E 2004a). Staff agrees with the applicant's prediction that there will be adequate natural gas supply and pipeline capacity to meet the project's needs.

Water Supply Reliability

The SFERP will obtain secondary treated effluent from the City of San Francisco's Southeast Waste Water Treatment Plant via a new 0.5-mile long pipeline. Recycled water will be produced (for gas turbine injection, inlet air chiller cooling and other plant uses) on site from this water at a new tertiary water treatment system included as part of the project (SFPUC 2005a, AFC §§ 1.2, 2.2.7.2, 2.2.7.3, 2.4.4, 7.2.1, 8.14, 10.2.3; SFPUC 2005d). Potable water will be supplied by the City's potable water distribution system via an approximately 300 foot pipeline (SFPUC 2005a, AFC §§ 7.3, 8.14, 10.2.3). Reclaimed water and demineralized water will be stored onsite in tanks in sufficient capacity to allow the plant to continue operating for hours in the unlikely event of an interruption in water supply. Note that there is no substantial consumptive use of cooling water, as would be the case with a combined cycle power plant. Staff believes these sources, combined with onsite storage capacity, yield sufficient likelihood of a reliable supply of water. (For further discussion of water supply, see the **Soil and Water Resources** section of this document.)

POWER PLANT RELIABILITY IN RELATION TO NATURAL HAZARDS

Natural forces can threaten the reliable operation of a power plant. High winds, tsunamis (tidal waves), seiches (waves in inland bodies of water), and flooding will not likely represent a hazard for this project, but seismic shaking (earthquake) may present a credible threat to reliable operation.

Seismic Shaking

The site lies within Seismic Zone 4 (SFPUC 2005a, AFC § 2.3.1); see that portion of this document entitled **Geology, Mineral Resources, and Paleontology**. The project will be designed and constructed to the latest appropriate LORS (SFPUC 2005a, AFC §§ 2.3.1, 10.2, Appendix 10). Compliance with current LORS applicable to seismic design represents an upgrading of performance during seismic shaking compared to older facilities, due to the fact that these LORS have been periodically and continually upgraded. By virtue of being built to the latest seismic design LORS, this project will likely perform at least as well as, and perhaps better than, existing plants in the electric power system. Staff has proposed conditions of certification to ensure this; see that portion of this document entitled **Facility Design**. In light of the historical performance of California power plants and the electrical system in seismic events, staff believes there is no special concern with power plant functional reliability affecting the electric system's reliability due to seismic events.

Tsunamis and Seiches

Although tsunamis and seiches can occur and cause tidal surges in the San Francisco Bay, the Bay greatly attenuates tsunamis that might reach the Golden Gate area and these events are extremely rare. Damaging tsunamis are not common on the California coast and devastating tsunamis have not occurred in historic times in the Bay area (SFPUC 2005a, AFC §§ 8.14.4.5, 8.14.6.5).

Flooding

Site average elevation is approximately 13.5 feet above mean sea level. The highest tide ever recorded in the project area is approximately 9.25 feet above the mean average sea level. A Storm Water Pollution Prevention Plan and Best Management Practices will be implemented during construction and operation to control erosion and sedimentation (SFPUC 2005a, AFC §§ 2.3.1, 8.14.4.5, 8.14.6.5, 8.14.8).

Staff believes there are no concerns with the power plant functional reliability due to tsunamis, seiches, and flooding events. For further discussion, see **Soil and Water Resources** and **Geology and Paleontology**.

COMPARISON WITH EXISTING FACILITIES

Industry statistics for availability factors (as well as many other related reliability data) are kept by the North American Electric Reliability Council (NERC). NERC continually polls utility companies throughout the North American continent on project reliability data through its Generating Availability Data System (GADS), and periodically summarizes and publishes the statistics on the Internet (http://www.nerc.com). NERC reports the following summary generating unit statistics for the years 1999 through 2003 (NERC 2005):

For Gas Turbine units (All MW sizes)

Equivalent Availability Factor = 88.37 percent

The gas turbines that will be employed in the project have been on the market for several years now, and can be expected to exhibit typically high availability. The applicant's prediction of an equivalent availability factor of 94 to 98 percent (SFPUC 2005a, AFC § 10.3.2) appears reasonable compared to the NERC figure for similar plants throughout North America (see above). In fact, these new machines can well be expected to outperform the fleet of various (mostly older) gas turbines that make up the NERC statistics. Further, since the plant will consist of three parallel gas turbine generating trains, maintenance can be scheduled during those times of year when the full plant output is not required to meet market demand, typical of industry standard maintenance procedures. The applicant's estimate of plant availability, therefore, appears realistic. The stated procedures for assuring design, procurement and construction of a reliable power plant appear to be in keeping with industry norms, and staff believes they are likely to yield an adequately reliable plant.

NOTEWORTHY PROJECT BENEFITS

The applicant proposes that one of the primary justifications for the SFERP is that it will improve reliability in San Francisco and the peninsula. This will be accomplished by replacing old unreliable units with a new highly-reliable technology. The fact that the project consists of three combustion turbine generators configured as independent equipment trains provides inherent reliability. A single equipment failure cannot disable more than one train, thus allowing the plant to continue to generate (at reduced output).

The gas turbines that will be employed in the project have been on the market for several years now, and can be expected to exhibit typically high availability. The applicant's prediction of an equivalent availability factor of 94 to 98 percent appears reasonable compared to the NERC figure for similar plants throughout North America (see above). Staff believes this should provide an adequate level of reliability.

RESPONSE TO AGENCY AND PUBLIC COMMENTS

Staff has received no comments in the area of Reliability.

CONCLUSION

The City and County of San Francisco predicts an equivalent availability factor of 94 to 98 percent, which staff believes is achievable. Based on a review of the proposal, staff concludes that the plant would be built and operated in a manner consistent with industry norms for reliable operation. This should provide an adequate level of reliability. No conditions of certification are proposed.

PROPOSED CONDITIONS OF CERTIFICATION

No conditions of certification are proposed.

REFERENCES

McGraw-Hill (McGraw-Hill Energy Information Services Group). 1994. Operational Experience in Competitive Electric Generation, an Executive Report, 1994.

NERC (North American Electric Reliability Council). 2005. 1999-2003 Generating Availability Report.

PG&E 2004a – Pacific Gas & Electric Company/Boschee (tn: 32098). Letter to confirm that PG&E does have capacity to serve the gas load with power plants on-line. Submitted to Hetch Hetchy Water & Power/Hollenbacher/CEC/Dockets on 8/13/04.

SFERP 2004g - CH2MHill/Carrier (tn:31268). Data Adequacy Supplement. Submitted to CEC/Pfanner/Dockets on 4/16/04.

SFPUC 2005a – San Francisco Public Utilities Commission/Hale (tn: 34403). Amendment A of the Application for Certification. Submitted to CEC/Therkelsen/Dockets on 3/25/05.

SFPUC 2005d – San Francisco Public Utilities Commission (tn: 36120). Amendment to the Project Description, Process & Cooling Water Supply. POS. 12/20/2005. Rec'd 12/22/2005.

TRANSMISSION SYSTEM ENGINEERING

Testimony of Mark Hesters

SUMMARY OF CONCLUSIONS

- The addition of the San Francisco Energy Reliability Project would not cause any negative impacts on the Pacific Gas & Electric transmission system and interconnection would require no downstream facilities.
- The San Francisco Energy Reliability Project switchyard and interconnection facilities will be adequate and reliable. The power plant switchyard, outlet lines, and termination are in accordance with good utility practices and will comply with all applicable laws, ordinances, regulations and standards, assuming the proposed conditions of certification are met.
- Adding local generation would facilitate the shutdown of existing generators and increase transmission system losses or would reduce transmission system losses and provide reactive power helping to maintain adequate voltage in the San Francisco Peninsula area (the **Local Systems Effects** testimony explains these impacts of the San Francisco Energy Reliability Project).

INTRODUCTION

The Transmission System Engineering (TSE) analysis identifies whether or not the transmission facilities associated with the proposed San Francisco Energy Reliability Project conform to all applicable laws, ordinances, regulations and standards (LORS), required for safe and reliable electric power transmission, and assesses whether or not the applicant has accurately identified all interconnection facilities required as a result of the project.

Staff's analysis evaluates the power plant switchyard, outlet lines, termination and downstream facilities identified by the applicant and staff, and provides proposed conditions of certification to ensure the project complies with applicable LORS during the design review, construction, operation and potential closure of the project.

Additionally, under the California Environmental Quality Act (CEQA), the Energy Commission conducts an environmental review of the "whole of the action," which may include facilities not licensed by the Energy Commission (Cal. Code Reg., tit. 14, §15378). The Energy Commission identifies and evaluates the environmental effects of construction and operation of any new or modified transmission facilities required for the project's interconnection to the electric grid, even if such facilities are beyond the project's interconnection with the existing transmission system and not under the permit authority of the Energy Commission.

The California Independent System Operator (CA ISO) is responsible for ensuring electric system reliability for all participating transmission owning utilities and determines both the standards necessary to achieve reliability and whether a proposed project conforms with those standards. The CA ISO will provide testimony on these matters at the Energy Commission’s hearings.

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

TSE Table 1 provides a brief list of the laws, ordinances, regulations and standards that apply to the proposed project. A detailed description of these LORS is provided in **TSE Attachment** 1.

TSE Table 1
Laws, Ordinances, Regulations, and Standards

Applicable Law	**Description**
Federal	
North American Electric Reliability Council (NERC Planning Standards	Principles designed to insure the adequacy and security of the transmission network
National Electric Safety Code 1999 (NESC)	Provides electrical, mechanical, civil and structural requirements for overhead electric line construction and operation
Regional	
Western Electricity Coordinating Council (WECC) Reliability Criteria	Insure continuity of load service and protection of the interconnected grid
State	
California Public Utilities Commission (CPUC) General Orders (GO) 95 and 128	Rules for overhead and underground line construction
CA ISO Reliability Criteria	Incorporate NERC and WECC standards and some additional requirements

SETTING

The City and County of San Francisco’s (CCSF) San Francisco Electric Reliability Project (SFERP) would be located in San Francisco and deliver power to Pacific Gas and Electric’s (PG&E) transmission network through an interconnection at the PG&E Potrero substation. Power would be produced by three simple-cycle gas turbines at 13.8 kilovolts (kV) (see Definition of Terms in Transmission System Engineering Attachment 2) and stepped up to 115 kV by three dedicated 13.8/115 kV grounded transformers. The SFERP power plant switchyard would consist of five circuit breakers organized in a three-phase ring bus configuration. Two three-phase 115 kV underground transmission circuits would connect the power plant switchyard to the Potrero substation (SFPUC 2005a, Page 5-2).

REGIONAL SETTING

The SFERP would be located in the City and County of San Francisco which sits at the end of an essentially radial electric network in PG&E's transmission system. Currently there are two major power plants operating in San Francisco; the Hunters Point Power Plant owned by PG&E and the Potrero Power plant owned by Mirant. PG&E anticipates shutting down the Hunters Point Power Plant in 2006. There are six PG&E transmission lines feeding San Francisco from the Peninsula (i.e. San Mateo County and parts of Santa Clara County), with one line, the Jefferson-Martin 230 kV Project, under construction.

PROJECT, SITE, AND VICINITY SETTING

The proposed power plant switchyard would consist of five circuit breakers in a 3-phase ring bus formation. Three of the circuit breakers would receive power from the generator transformers and the remaining two circuit breakers would connect to the Potrero substation. The latter interconnection would be through two approximately 3,000-foot three-phase 115 kV solid dielectric underground circuits and underground/overhead transmission structures located at the Potrero substation (SFPUC 2005a, Page 5-1). The applicant is seeking certification for two interconnection options; one would enter the Potrero Substation from Illinois Street and the other from 22nd Street. Both interconnections to the Potrero Substation are acceptable. The power plant switchyard, outlet lines, and termination are in accordance with good utility practices and are acceptable and **Conditions of Certification TSE 1-8,** would insure compliance with applicable LORS.

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

METHOD AND THRESHOLD FOR DETERMINING SIGNIFICANCE

For interconnecting a proposed generating unit to the grid, a System Impact Study (SIS) and a Facilities Study (FS) are generally performed to determine the alternate and preferred interconnection methods. The studies also determine the downstream transmission system impacts of the proposed project, and the mitigation measures needed to insure system conformance with performance levels required by utility reliability criteria, NERC planning standards, WECC reliability criteria, and CA ISO reliability criteria. They determine both positive and negative impacts of a proposed project and determine the alternate and preferred additional transmission facilities or other mitigation measures for any reliability criteria violations. The studies are conducted with and without the new generation project and its interconnection facilities. Load Flow, Transient Stability, Post-transient Load Flow, and Short Circuit studies are normally included.

The studies are focused on thermal overloads, voltage deviations, system stability (excessive oscillations in generators and transmission system, voltage collapse, loss of loads or cascading outages), and short circuit duties. The studies must be conducted under the normal condition (N-0) of the system and also for all credible contingency/emergency conditions, which includes the loss of a single system element (N-1) such as a transmission line, transformer, or a generator and the simultaneous loss of two system elements (N-2), such as two transmission lines or a transmission line and a generator. Equipment that is loaded beyond 100 percent of its thermal or path rating constitutes a violation of the reliability criteria. Generally voltage deviations must be within 95 percent and 105 percent of the facility rating. In addition to the above analysis, the studies may be performed to verify whether sufficient active or reactive power is available in the area system or area sub-system to which the new generator project would be interconnected.

New or modified downstream facilities that are a reasonably foreseeable consequence of approval of the project are analyzed from an engineering and environmental perspective but are not licensed by the Commission[1].

SCOPE OF STUDIES

PG&E completed several transmission studies for the SFERP. The first studies assumed the project originally proposed by the applicant (SFERP 2004a) and included four simple-cycle gas turbines (195 MW) at the Potrero site. Both PG&E and the CA ISO agreed that an additional study of the current proposal for three turbines at the current site was not necessary because the study of four turbines was already completed and showed that there were no adverse affects on the transmission system (SFERP 2004g, TSE attachment). Staff agrees with PG&E and the CA ISO.[2] Four studies, the System Impact Study, the Facilities Study, and the Updating Facilities Study and the Feasibility/Updating Facilities Study II, have been completed by PG&E and are briefly summarized below. Even though these studies didn't analyze the SFERP exactly as it is proposed at the CEC the study results are still applicable to the proposed SFERP interconnections at the Potrero Substation. The SFERP received Final Interconnection Approval from the CA ISO on June 27, 2005 (CA ISO 2005a, page 1).

System Impact Study

The SIS analyzed four turbines (195 MW) with a proposed interconnection at the Potrero substation. The SIS evaluated the impacts of SFERP under two scenarios:

- 2005 PG&E Summer Peak base case with 1-in-10 year peak load conditions for the San Francisco/Peninsula area. Hunters Point Unit 4 was available in the without SFERP case and unavailable in the with SFERP case.
- 2005 PG&E Fall base case with loads approximately 96-percent of those used in the Summer Peak case and Potrero Unit 3 unavailable due to overhaul.

The SIS included Steady State Power Flow analysis, Dynamic Stability studies, and Short Circuit studies. Hunters Point Unit 4 was available in the without SFERP cases and was removed for the with SFERP cases. The Jefferson-Martin 230 kV transmission project was not included in either case (SFERP 2004a, Appendix 5).

---

[1] If the transmission owning utility (PG&E in this case) and the CA ISO (if the transmission facilities are in the CA ISO control area) determine that downstream facilities are needed, the facilities are licensed by the CPUC or the interconnecting utility.

[2] A smaller project will have impacts similar to or less than a larger project. Since the studies of the larger project (four turbines) indicated that there would be no adverse impacts the smaller project (three turbines) would have no adverse impacts as well.

Facilities Study

The Facilities Study analyzed two 2005 Summer Peak cases with four turbines connected to the Potrero substation:

- Case one was exactly like the 2005 Summer Peak base case in the SIS.
- Case two studied four turbines with Mirant's Potrero Power Plant Unit 7 Project operating, Hunters Point Unit 4 unavailable, three Potrero-Hunters Point 115 kV cables operating and the Jefferson-Martin 230 kV transmission line operating.

Updating Facilities Study

The Updating Facilities Study analyzed the SFERP under the following conditions (SFERP 2004p, Page 6):

- 2007 Summer Peak Base Case with 1-in-10 year summer heat wave load in the San Francisco/Peninsula area with three turbines (net output 145 MW) connected to the Potrero substation with Mirant's Potrero Power Plant Unit 7 operating, three 115 kV underground cables between the Potrero and Hunters Point substations operating and the Jefferson-Martin 230 kV transmission line operating.

Feasibility/Updating Facilities Study II

The Feasibility/Updating Facilities Study II analyzed whether or not it was feasible to connect the SFERP to the Potrero Substation through underground circuits from the new plant location and then determined the cost for the interconnection.

STUDY RESULTS

Power Flow Study Results

The Power Flow Study results from the SIS, Facilities Study and Updating Facilities Study indicate that interconnection and operation of the SFERP will have no adverse electrical system impacts and will require no downstream mitigation measures. An emergency one percent pre-project overload of the San Mateo-Belmont 115 kV line increased to a seven percent overload with the addition of the SFERP (SFERP 2004a, Appendix 5, Page 12). However, this pre-existing overload is no longer an issue as PG&E remedied the overload through the addition of a 230/115 kV transformer at the Ravenswood Substation in San Mateo County in May, 2004. No other overloads attributed to the SFERP were identified by the studies.

The PG&E power flow studies included an analysis of the transmission system impacts with Mirant's proposed Potrero Power Plant Unit 7 operating as well as the SFERP. Staff believes that it is unlikely that both projects will be completed because Mirant has been unable to obtain critical permits from the City and County of San Francisco for the Potrero Power Plant Unit 7 Project. Hence, any theoretical downstream impacts that result from the interconnection and operation of both the SFERP and Potrero Power Plant Unit 7 are considered highly unlikely and are thus, not analyzed in this assessment.

Compliance with LORS

The project will comply with the NERC/WSCC, CA ISO and NERC planning standards and reliability criteria. The proposed SFERP includes overhead and underground transmission lines, as well as substation and switchyard facilities. The applicant will design, build and operate the proposed facilities according to the provisions of GO 95 and GO 128 or the NESC, Title 8, NEC, applicable interconnection and related industry standards. The proposed **TSE Conditions of Certification1-8** will insure that the project complies with LORS.

DIRECT/INDIRECT IMPACTS AND MITIGATION

The results of the System Impact Study, the Facilities Study and the Updating Facilities Study did not identify any overloads and associated mitigation measures that would result from the interconnection and operation of the SFERP.

CUMULATIVE IMPACTS AND MITIGATION

There are currently no proposed projects other than the Potrero Power Plant Unit 7 that would cumulatively create transmission system impacts with SFERP. The SIS for the SFERP analyzed the impacts of the four turbines available to the CCSF connected to the Potrero Substation and found that there were no impacts. Staff concurs with PG&E and the CA ISO that the addition of a fourth turbine at another site in San Francisco would likely have similar impacts on the transmission system[3]. The Updating Facilities Study included an analysis of the impacts of the SFERP in conjunction with the 615 MW Potrero Power Plant Unit 7 Project which provides some insight about the transmission facilities that would be needed if both the SFERP and another large generator were sited in San Francisco. The interconnection of both projects, according to the study, would likely require two approximately 6-mile 115 kV underground cables from the Martin Substation to the Potrero Substation.

NOTEWORTHY PUBLIC BENEFITS

Locating a power plant like the SFERP in the San Francisco load center would reduce system losses or facilitate the shutdown of existing generators in the San Francisco Peninsula Area. Staff discusses the reduction in system losses and other potential benefits of the SFERP in the Local System Effects analysis contained as part of this Final Staff Assessment. The SFERP has been identified in the CA ISO Action Plan for San Francisco as one of the system upgrades required for the CA ISO to facilitate the shutdown of the existing Potrero generators (CA ISO 2004b). The shut down of the existing generators would actually increase system losses.

CONCLUSIONS

- Addition of the SFERP project does not cause any negative impacts on the PG&E transmission system and interconnection would require no downstream facilities.

[3] Because it would interconnect farther away from the SFERP than a fourth turbine connecting to the Potrero Substation, a new turbine near the San Francisco Airport would have fewer cumulative transmission impacts than a fourth turbine at the SFERP.

- The SFERP does not cause any normal or contingency condition overloads to the transmission grid.
- The SFERP does not cause voltage criteria or system stability criteria violations.
- The SFERP project switchyard and interconnection facilities will be adequate and reliable. The power plant switchyard, outlet lines, and termination are in accordance with good utility practices and are acceptable. Staff concludes that these facilities will comply with all applicable LORS, assuming the conditions of certification are met.
- Adding local generation such as the SFERP would reduce transmission system losses, or would facilitate the shutdown of existing generators in the San Francisco Peninsula region.
- The existing circuit breakers are capable of handling the increase in fault level with the addition of the SFERP.

PROPOSED CONDITIONS OF CERTIFICATION

TSE-1 The project owner shall furnish to the CPM and to the CBO a schedule of transmission facility design submittals, a Master Drawing List, a Master Specifications List, and a Major Equipment and Structure List. The schedule shall contain a description and list of proposed submittal packages for design, calculations, and specifications for major structures and equipment. To facilitate audits by Energy Commission staff, the project owner shall provide designated packages to the CPM when requested.

Verification: At least 60 days (or a lesser number of days mutually agreed to by the project owner and the CBO) prior to the start of construction, the project owner shall submit the schedule, a Master Drawing List, and a Master Specifications List to the CBO and to the CPM. The schedule shall contain a description and list of proposed submittal packages for design, calculations, and specifications for major structures and equipment (see a list of major equipment in **Table 1: Major Equipment List** below). Additions and deletions shall be made to the table only with CPM and CBO approval. The project owner shall provide schedule updates in the Monthly Compliance Report.

Table 1: Major Equipment List
Breakers
Step-up Transformer
Switchyard
Busses
Surge Arrestors
Disconnects
Take off facilities
Electrical Control Building
Switchyard Control Building
Transmission Pole/Tower
Grounding System

TSE-2 Prior to the start of construction the project owner shall assign an electrical engineer and at least one of each of the following to the project: A) a civil engineer; B) a geotechnical engineer or a civil engineer experienced and knowledgeable in the practice of soils engineering; C) a design engineer, who is either a structural engineer or a civil engineer fully competent and proficient in the design of power plant structures and equipment supports; or D) a mechanical engineer. (Business and Professions Code Sections 6704 et seq., require state registration to practice as a civil engineer or structural engineer in California.)

The tasks performed by the civil, mechanical, electrical or design engineers may be divided between two or more engineers, as long as each engineer is responsible for a particular segment of the project (e.g., proposed earthwork, civil structures, power plant structures, equipment support). No segment of the project shall have more than one responsible engineer. The transmission line may be the responsibility of a separate California registered electrical engineer. The civil, geotechnical or civil and design engineer assigned in conformance with Facility Design condition **GEN-5**, may be responsible for design and review of the TSE facilities.

The project owner shall submit to the CBO for review and approval, the names, qualifications and registration numbers of all engineers assigned to the project. If any one of the designated engineers is subsequently reassigned or replaced, the project owner shall submit the name, qualifications and registration number of the newly assigned engineer to the CBO for review and approval. The project owner shall notify the CPM of the CBO's approval of the new engineer. This engineer shall be authorized to halt earthwork and to require changes; if site conditions are unsafe or do not conform with predicted conditions used as a basis for design of earthwork or foundations.

The electrical engineer shall:

1. Be responsible for the electrical design of the power plant switchyard, outlet and termination facilities; and
2. Sign and stamp electrical design drawings, plans, specifications, and calculations.

Verification: At least 30 days (or a lesser number of days mutually agreed to by the project owner and the CBO) prior to the start of rough grading, the project owner shall submit to the CBO for review and approval, the names, qualifications and registration numbers of all the responsible engineers assigned to the project. The project owner shall notify the CPM of the CBO's approvals of the engineers within five days of the approval.

If the designated responsible engineer is subsequently reassigned or replaced, the project owner has five days in which to submit the name, qualifications, and registration number of the newly assigned engineer to the CBO for review and approval. The project owner shall notify the CPM of the CBO's approval of the new engineer within five days of the approval.

TSE-3 If any discrepancy in design and/or construction is discovered in any engineering work that has undergone CBO design review and approval, the project owner shall document the discrepancy and recommend corrective action. (1998 CBC, Chapter 1, Section 108.4, Approval Required; Chapter 17, Section 1701.3, Duties and Responsibilities of the Special Inspector; Appendix Chapter 33, Section 3317.7, Notification of Noncompliance]. The discrepancy documentation shall become a controlled document and shall be submitted to the CBO for review and approval and shall reference this condition of certification.

Verification: The project owner shall submit a copy of the CBO's approval of any corrective action taken to resolve a discrepancy to the CPM within 15 days of receipt. If corrective action is not approved, the project owner shall advise the CPM, within five days, of the reason for disapproval, and the revised corrective action required to obtain the CBO's approval.

TSE-4 For the power plant switchyard, outlet line and termination, the project owner shall not begin any increment of construction until plans for that increment have been approved by the CBO. These plans, together with design changes and design change notices, shall remain on the site for one year after completion of construction. The project owner shall request that the CBO inspect the installation to ensure compliance with the requirements of applicable LORS. The following activities shall be reported in the Monthly Compliance Report:

a) receipt or delay of major electrical equipment;

b) testing or energization of major electrical equipment; and

c) the number of electrical drawings approved, submitted for approval, and still to be submitted.

Verification: At least 30 days (or a lesser number of days mutually agreed to by the project owner and the CBO) prior to the start of each increment of construction, the project owner shall submit to the CBO for review and approval the final design plans, specifications and calculations for equipment and systems of the power plant switchyard, outlet line and termination, including a copy of the signed and stamped statement from the responsible electrical engineer attesting to compliance with the applicable LORS, and send the CPM a copy of the transmittal letter in the next Monthly Compliance Report.

TSE-5 The project owner shall ensure that the design, construction and operation of the proposed transmission facilities will conform to all applicable LORS, including the requirements listed below. The project owner shall submit the required number of copies of the design drawings and calculations as determined by the CBO.

a) The power plant switchyard and outlet line shall meet or exceed the electrical, mechanical, civil and structural requirements of CPUC General Order 95, CPUC General Order 128 or National Electric Safety Code (NESC), Title 8 of the California Code and Regulations (Title 8), Articles

35, 36 and 37 of the “High Voltage Electric Safety Orders”, CA ISO standards, National Electric Code (NEC) and related industry standards.

1. The power plant switchyard shall consist of five circuit breakers in a 3-phase ring bus formation.
2. The outlet line shall consist of two approximately 3,000 foot solid dielectric underground circuits and an overhead/underground structure.
3. The outlet line shall enter the existing Potrero Substation from either Illinois Street or 22nd Street.

b) Breakers and busses in the power plant switchyard and other switchyards, where applicable, shall be sized to comply with a short-circuit analysis.

c) Outlet line crossings and line parallels with transmission and distribution facilities shall be coordinated with the transmission line owner and comply with the owner’s standards.

d) The project conductors shall be sized to accommodate the full output from the project.

e) Termination facilities shall comply with applicable PG&E interconnection standards.

f) The project owner shall provide to the CPM:

1. The final Detailed Facility Study (DFS) including a description of facility upgrades, operational mitigation measures, and/or Special Protection System (SPS) sequencing and timing if applicable,
2. Executed project owner and CA ISO Facility Interconnection Agreement

Verification: At least 60 days prior to the start of construction of transmission facilities (or a lessor number of days mutually agree to by the project owner and CBO, the project owner shall submit to the CBO for approval:

a) Design drawings, specifications and calculations conforming with CPUC General Order 95, CPUC General Order 128 or NESC, Title 8, Articles 35, 36 and 37 of the “High Voltage Electric Safety Orders”, NEC, applicable interconnection standards and related industry standards, for the poles/towers, foundations, anchor bolts, conductors, grounding systems and major switchyard equipment.

b) For each element of the transmission facilities identified above, the submittal package to the CBO shall contain the design criteria, a discussion of the calculation method(s), a sample calculation based on “worst case conditions”[4] and a statement signed and sealed by the registered engineer in responsible charge, or other acceptable alternative verification, that the transmission element(s) will conform with CPUC General Order 95, CPUC General Order 128 or NESC, Title 8, California

[4] Worst case conditions for the foundations would include for instance, a dead-end or angle pole.

Code of Regulations, Articles 35, 36 and 37 of the, “High Voltage Electric Safety Orders”, NEC, applicable interconnection standards, and related industry standards.

c) Electrical one-line diagrams signed and sealed by the registered professional electrical engineer in responsible charge, a route map, and an engineering description of equipment and the configurations covered by requirements **TSE-5** a) through f) above.

d) The final DFS, including a description of facility upgrades, operational mitigation measures, and/or SPS sequencing and timing if applicable, shall be provided concurrently to the CPM.

TSE-6 The project owner shall inform the CPM and CBO of any impending changes, which may not conform to the requirements **TSE-5** a) through f), and have not received CPM and CBO approval, and request approval to implement such changes. A detailed description of the proposed change and complete engineering, environmental, and economic rationale for the change shall accompany the request. Construction involving changed equipment or substation configurations shall not begin without prior written approval of the changes by the CBO and the CPM. The CBO and CPM could approve changes in equipment or interconnection design that comply CPUC General Order 95, CPUC General Order 128 or NESC, Title 8, California Code of Regulations, Articles 35, 36 and 37 of the, “High Voltage Electric Safety Orders”, NEC, applicable interconnection standards, and related industry standards and do not require a new System Impact Study or Facility Study.

Verification: At least 60 days prior to the construction of transmission facilities, the project owner shall inform the CBO and the CPM of any impending changes which may not conform to requirements of **TSE-5** and request approval to implement such changes.

TSE-7 The project owner shall provide the following Notice to the California Independent System Operator prior to synchronizing the facility with the California Transmission system:

1. At least one week prior to synchronizing the facility with the grid for testing, provide the CA ISO a letter stating the proposed date of synchronization; and
2. At least one business day prior to synchronizing the facility with the grid for testing, provide telephone notification to the CA ISO Outage Coordination Department.

Verification: The project owner shall provide copies of the CA ISO letter to the CPM when it is sent to the CA ISO one week prior to initial synchronization with the grid. The project owner shall contact the CA ISO Outage Coordination Department, Monday through Friday, between the hours of 0700 and 1530 at (916) 351-2300 at least one business day prior to synchronizing the facility with the grid for testing. A report of conversation with the CA ISO shall be provided electronically to the CPM one day before synchronizing the facility with the California transmission system for the first time.

TSE-8 The project owner shall be responsible for the inspection of the transmission facilities during and after project construction, and any subsequent CPM and

CBO approved changes thereto, to ensure conformance with CPUC General Order 95, CPUC General Order 128 or NESC, Title 8, CCR, Articles 35, 36 and 37 of the, “High Voltage Electric Safety Orders”, applicable interconnection standards, NEC and related industry standards. In case of non-conformance, the project owner shall inform the CPM and CBO in writing, within 10 days of discovering such non-conformance and describe the corrective actions to be taken.

Verification: Within 60 days after first synchronization of the project, the project owner shall transmit to the CPM and CBO:

a) “As built” engineering description(s) and one-line drawings of the electrical portion of the facilities signed and sealed by the registered electrical engineer in responsible charge. A statement attesting to conformance with CPUC General Order 95, CPUC General Order 128 or NESC, Title 8, California Code of Regulations, Articles 35, 36 and 37 of the, “High Voltage Electric Safety Orders”, and applicable interconnection standards, NEC, related industry standards, and these conditions shall be provided concurrently.

b) An “as built” engineering description of the mechanical, structural, and civil portion of the transmission facilities signed and sealed by the registered engineer in responsible charge or acceptable alternative verification. “As built” drawings of the electrical, mechanical, structural, and civil portion of the transmission facilities shall be maintained at the power plant and made available, if requested, for CPM audit as set forth in the “Compliance Monitoring Plan”.

c) A summary of inspections of the completed transmission facilities, and identification of any nonconforming work and corrective actions taken, signed and sealed by the registered engineer in charge.

REFERENCES

CA ISO2004a – California Independent System Operator. San Francisco Electric Reliability Project Final Interconnection Approval, May 28, 2004.

CA ISO2004b - California Independent System Operator, Action Plan for San Francisco, Options and Risks, Memorandum from Marcie Edwards to the CA ISO Board of Governors, September 10, 2004.

CA ISO2005a – California Independent System Operator. San Francisco Electric Reliability Project Final Interconnection Approval, Submitted to CEC/Dockets on 6/27/05

PG&E2005a - Pacific Gas and Electric Company. Feasibility/Updating Facilities Study II, Generation Interconnection, City and County of San Francisco, San Francisco Electric Reliability Power Project, June 8, 2005.

SFERP2004a - City and County of San Francisco/Blout (tn: 31130). Application for Certification San Francisco Electric Reliability Project - 145-megawatt natural gas-fired peaking power plant located in San Francisco. Submitted to CEC/Therkelsen/Dockets on 3/18/04.

SFERP2004b - CH2MHill/Carrier (tn: 31126). Transmittal of Appendix 5, System Impact Study. Submitted to CEC/Pfanner/Dockets on 3/18/04.

SFERP2004g - CH2MHill/Carrier (tn: 31268). Data Adequacy Supplement. Submitted to CEC/Pfanner/Dockets on 4/16/04.

SFERP2004p – CH2MHill/Carrier (tn: 31858). Data Responses Set 1A. Attachment TSE-70A, Updating Facilities Study. Submitted to CEC/Pfanner/Dockets on 7/6/04.

SFPUC 2005a – San Francisco Public Utilities Commission/Hale (tn: 34403). Amendment A of the Application for Certification. Submitted to CEC/Therkelsen/Dockets on 3/25/05.

TSE ATTACHMENT 1 LORS

- North American Electric Reliability Council (NERC) Planning Standards provide policies, standards, principles and guides to assure the adequacy and security of the electric transmission system. With regard to power flow and stability simulations, these Planning Standards are similar to WECC's Criteria for Transmission System Contingency Performance. The NERC planning standards provide for acceptable system performance under normal and contingency conditions. The NERC planning standards apply not only to interconnected system operation but also to individual service areas (NERC 1998).
- Western Electric Coordinating Council (WECC) Reliability Criteria provide the performance standards used in assessing the reliability of the interconnected system. These Reliability Criteria require the continuity of service to loads as the first priority and preservation of interconnected operation as a secondary priority. The WECC Reliability Criteria include the Reliability Criteria for Transmission System Planning, Power Supply Design Criteria, and Minimum Operating Reliability Criteria. Analysis of the WECC system is based to a large degree on WECC Section 4 "Criteria for Transmission System Contingency Performance" which requires that the results of power flow and stability simulations verify established performance levels. Performance levels are defined by specifying the allowable variations in voltage, frequency and loading that may occur on systems other than the one in which a disturbance originated. Levels of performance range from no significant adverse effect outside a system area during a minor disturbance (loss of load or facility loading outside emergency limits) to a performance level that only seeks to prevent system cascading and the subsequent blackout of islanded areas. While controlled loss of generation, load, or system separation is permitted in extreme circumstances, their uncontrolled loss is not permitted (WECC 1998).
- California Public Utilities Commission (CPUC) General Order 95 (GO-95), "Rules for Overhead Electric Line Construction," formulates uniform requirements for construction of overhead lines. Compliance with this order ensures adequate service and safety to persons engaged in the construction, maintenance, operation, or use of overhead electric lines and to the public in general.
- California Public Utilities Commission (CPUC) General Order 128 (GO-128), "Rules for Underground Electric Line Construction," formulates uniform requirements for construction of overhead lines. Compliance with this order ensures adequate service and safety to persons engaged in the construction, maintenance, operation, or use of overhead electric lines and to the public in general.
- National Electric Safety Code 1999 provides electrical, mechanical, civil and structural requirements for overhead electric line construction and operation.
- CA ISO's Reliability Criteria also provide policies, standards, principles, and guides to assure the adequacy and security of the electric transmission system. With regard to power flow and stability simulations, these Planning Standards are similar to WECCs Criteria for Transmission System Contingency Performance and the NERC Planning Standards. The CA ISO Reliability Criteria incorporate the WECC Criteria

and NERC Planning Standards. However, the CA ISO Reliability Criteria also provide some additional requirements that are not found in the WECC Criteria or the NERC Planning Standards. The CA ISO Reliability Criteria apply to all existing and proposed facilities interconnecting to the CA ISO controlled grid. It also applies when there are any impacts to the CA ISO grid due to facilities interconnecting to adjacent controlled grids not operated by the CA ISO.

TSE ATTACHMENT 2 DEFINITION OF TERMS

AAC	All Aluminum conductor.
ADR	Alternative Dispute Resolution
Ancillary Services Market	The market for services other than scheduled energy that are required to maintain system reliability and meet WECC/NERC operating criteria. Such services include spinning, non-spinning, replacement reserves, regulation (AGC), voltage control and black start capability.
Ampacity	Current-carrying capacity, expressed in amperes, of a conductor at specified ambient conditions, at which damage to the conductor is nonexistent or deemed acceptable based on economic, safety, and reliability considerations.
Ampere	The unit of measure of electric current; specifically, a measure of the rate of flow of electrons past a given point in an electric conductor such as a power line.
Available Transmission Capacity (i.e., ATC)	Available Transmission Capacity in any hour is equal to Operational Transmission Capacity for that hour minus Existing Transmission Contracts for that same hour (ATC = OTC - ETC). (See the other definitions below).
Breaker	Circuit breaker - An automatic switch that stops the flow of electric current in a suddenly overloaded or otherwise abnormally stressed electric circuit.
Bundled Conductor	Two or more wires, connected in parallel through common switches, that act together to carry current in a single phase of an electric circuit.
Bus	Conductors that serve as a common connection for multiple transmission lines.

CA ISO	California Independent System Operator - The CA ISO is the FERC regulated control area operator of the CA ISO transmission grid. Its responsibilities include providing non-discriminatory access to the grid, managing congestion, maintaining the reliability and security of the grid, and providing billing and settlement services. The CA ISO has no affiliation with any market participant.
CA ISO Controlled Grid	The combined transmission assets of the Participating Transmission Owners (PTOs) that are collectively under the control of the CA ISO.
CA ISO Reliability Criteria	Reliability standards established by the NERC, WECC, and the ISO, as amended from time to time, including any requirements of the NRC.
CA ISO Planning Process	Annual studies conducted by the PTO's and CA ISO in an open stakeholder process. These studies determine the future transmission reinforcements necessary to enable the ISO Controlled Grid to meet the ISO Reliability Criteria. The CA ISO Planning Process also includes studies of new resource connections and third party proposals for new additions to the ISO Controlled Grid.
CA ISO Tariff	Document filed with the appropriate regulatory authority (FERC) specifying lawful rates, charges, rules, and conditions under which the utilities provide services to parties. A tariff typically includes rate schedules, list of contracts, rules, and sample forms.
Capacitor	An electric device used to store charge temporarily, generally consisting of two metallic plates separated by a dielectric.
Cogeneration	The consecutive generation of thermal and electric or mechanical energy.
Conductor	The part of the transmission line (the wire) which carries the current.

Congestion	The condition that exists when market participants seek to dispatch in a pattern which would result in power flows that cannot be physically accommodated by the system. Although the system will not normally be operated in an overloaded condition, it may be described as congested based on requested/desired schedules.
Congestion Management	Congestion management is a CA ISO scheduling protocol that is used to resolve Congestion.
Contingency	Disconnection or separation, planned or forced, of one or more components from the electric system.
Day-Ahead Market	The forward market for the supply of electrical power at least 24 hours before delivery to Buyers and End-Use Customers.
Demand	Load plus any exports from an electric system.
Demand Forecast	An estimate of demand (electric load) over a designated period of time.
Dispatch	The operating control of an integrated electric system to: (i) assign specific generators and other sources of supply to effect the supply to meet the relevant area Demand taken as Load rises of falls; (ii) control operations and maintenance of high voltage lines, substations, and equipment, including administration of safety procedures; (iii) operate interconnections (iv) manage energy transactions with other interconnected Control Areas; and (v) curtail Demand.
dV/dQ	The partial derivative of the voltage at a bus with respect to the reactive injection at that bus. (See any elementary college calculus text for further discussion of partial derivatives.) The point at which dV/dQ approaches infinity is defined as the point of voltage collapse.
Emergency Condition	The system condition when one or more system elements are forced (not scheduled) out of service.

Emergency Overload	Loading of a transmission system element above its Emergency Rating during an Emergency Condition.
Emergency Rating	A special rating established for short-term use in the event of a forced line or transformer outage (e.g., an emergency). An emergency rating may be expressed as a percentage of the normal rating (e.g., 115 percent of normal) or as an elevated current rating. For example, the normal rating for a conductor may be 1000 amperes and the emergency rating may be 1100 amperes.
Excessive Voltage Deviation	A sudden change in voltage at any substation as a result of a Contingency that exceeds established allowable levels of change.
Existing Transmission Contract (i.e., ETC)	A contract for transmission services that was in place prior to the start of ISO operations.
Fault Duty	The maximum amount of short-circuit current which must be interrupted by a given circuit breaker.
FERC	Federal Energy Regulatory Commission
General Order 95	California Public Utilities Commission (CPUC) General Order which specifies transmission line clearance requirements.
Generation Outlet Line	Transmission facilities (circuit, transformer, circuit breaker, etc.) linking generation to the main grid.
Generation Tie	Transmission facilities (circuit, transformer, circuit breaker, etc.) linking generation to the main grid.
Generator	A machine capable of converting mechanical energy into electrical energy.
Heat Rate	The amount of energy input to an electric generator required to obtain a given value of energy output. Usually expressed in terms of British Thermal Units per kilowatt hour (Btu/kWh).

Hour-Ahead Market	The electric power futures market that is established 1-hour before delivery to End-Use Customers.
Imbalance Energy	Energy not scheduled in advance that is required to meet energy imbalances in real-time. This energy is supplied by Participating Generators under the CA ISO's control, providing spinning and non-spinning reserves, replacement reserves, and regulation, and other generators able to respond to the CA ISO's request for more or less energy.
Interconnected System Reliability	See Reliability.
Kcmil or kcm	One thousand circular mils. A unit of the conductor's cross sectional area which, when divided by 1,273, gives the area in square inches.
Kv	Kilovolt - A unit of potential difference, or voltage, between two conductors of a circuit, or between a conductor and the ground.
Load	The rate expressed in kilowatts, or megawatts, at which electric energy is delivered to or by a system, or part of a system to end use customers at a given instant or averaged over an designated interval of time. (Also see Demand.)
Load Factor	The average Load over a given period (e.g., one year) divided by the peak Load in the period.
Loop	An electrical connection where a line is opened and a new substation is inserted into the opening. A looped configuration creates two lines, one from each of the original end points to the new substation. A looped configuration is more reliable than a tap configuration because the looped configuration provides two lines into the substation rather than just one in a tap configuration. Also, see Tap below.
Low Voltage	Voltage at any substation that is below the minimum acceptable level.

Marginal Unit	The Generator (or Load) that sets the market clearing price in the ISO's Ancillary Services Market (or the Power Exchange's energy market). The marginal unit is the Generator or Load that had the highest accepted bid for energy or Demand reduction.
MVAr	Megavar - One megavolt ampere reactive (a measure of reactive power). Reactive power demand is generally associated with motor loads and generation units or static reactive sources must supply this demand in the system.
MVA	Megavolt ampere - A unit of apparent power: equal to the product of the line voltage in kilovolts, the current in amperes, and the square root of 3 divided by 1000.
MW	Megawatt - A unit of power equivalent to 1,341 horsepower.
NERC	North American Electric Reliability Council
Nominal Voltage	Also known as Normal Voltage. The voltage at which power can be delivered to loads without damage to customer equipment or violation of CA ISO Reliability Criteria when the system is under Normal Operation.
Normal Operation	When all customers receive the power they are entitled to without interruption and at steady voltage, and no element of the transmission system is loaded beyond its continuous rating.
NRC	Nuclear Regulatory Commission
N-1 Contingency	A forced outage of one system element (e.g., a transmission line or generator).
N-2 Contingency	A forced outage of two system elements usually (but not exclusively) caused by one single event. Examples of an N-2 Contingency include loss of two transmission circuits on a single tower line or loss of two elements connected by a common circuit breaker due to the failure of that common breaker.

Operational Transfer Capability (i.e., OTC)	The maximum amount of power which can be reliably transmitted over an electrical path in conjunction with the simultaneous reliable operation of all other paths. This limit is typically defined by seasonal operating studies, and should not be confused with a path rating. Also referred to as OTC.
Outlet	Transmission facilities (circuit, transformer, circuit breaker, etc.) linking generation to the main grid.
Participating Generator	A generator that has signed an agreement with the CA ISO to abide by the rules and conditions specified in the CA ISO Tariff.
Participating Transmission Owner (i.e., PTO)	A Participating Transmission Owner is an electric transmission owning company that has turned over operational control of some or all of their electric transmission facilities to the CA ISO. Currently, the three Participating Transmission Owners are PG&E, SCE, and SDG&E.
Path Rating	The maximum amount of power which can be reliably transmitted over an electrical path under the best set of conditions. Path ratings are defined and specified in the WECC Path Rating Catalog.
PG&E	Pacific Gas & Electric Company
PG&E Interconnection Handbook	Detailed instructions to new customers (either load or generation) on how to interconnect to the PG&E electric system.
Post-Transient Voltage Deviation	The change in voltage from pre-contingency to post-contingency conditions once the system has had time to readjust.
Power Flow	A generic term used to describe the type, direction, and magnitude of actual or simulated electrical power flows on electrical systems.

Power Flow Analysis	A power flow analysis is a forward looking computer simulation of all major generation and transmission system facilities that identifies overloaded circuits, transformers and other equipment as well as system voltage levels under both Normal and Emergency Conditions.
Pump	A hydroelectric generator that acts as a motor and pumps water stored in a reservoir to a higher elevation.
Q/V Curve	A graphical representation of the voltage a given substation bus as a function of the reactive injection at that bus.
RAS	Remedial Action Scheme - An automatic control provision (e.g., trip a generation unit to mitigate a circuit overload).
Reactive Power	The portion of apparent power that does no work in an alternating current circuit but must be available to operate certain types of electrical equipment. Reactive Power is most commonly supplied by generators or by electrostatic equipment, such as shunt capacitors.
Reactive Margin	Reactive Power must be available at all load buses to prevent voltage collapse. Reactive margin is the amount of additional reactive load, usually measured in MVAR's, which may be added at a particular bus before the system experiences voltage collapse.
Reactor	An electric device used to store electric current temporarily, generally consisting of a coil of wire wound around a magnetic core.
Real Power	Real power is the work-producing component of apparent power and is required to operate any electrical equipment that performs energy conversion. Examples of this electrical equipment would be a heater, a lamp, or a motor. Real power is usually metered in units of kilowatt-hours (kWh).
Real-Time Market	The competitive generation market controlled and coordinated by the CA ISO for arranging real-time imbalance power.

Reconductor	The removal of old conductors on a transmission or distribution line followed by replacement of these conductors with new higher capacity conductors.
Reliability	The degree of performance of the elements of the bulk electric system that results in electricity being delivered to customers within accepted standards and in the amount desired. May be measured by the frequency, duration, and magnitude of adverse effects on the electric supply.
Reliability Criteria	Principals used to design, plan, operate, and assess the actual or projected reliability of an electric system.
Reliability Must-Run (i.e., RMR)	The minimum generation (number of units or MW output) required by the CA ISO to be on line to maintain system reliability in a local area.
SCE	Southern California Edison Company
SDG&E	San Diego Gas and Electric Company
Sensitivity Study	An analysis to determine the impact of varying one or more parameters on the results of the original analysis.
Series Capacitor	A static electrical device that is connected in-line with a transmission circuit that allows for higher power transfer capability by reducing the circuit's overall impedance.
Shunt Capacitor	A static electrical device that is connected between an electrical conductor and ground. A shunt capacitor normally will increase the voltage on a transmission circuit by providing reactive power to the electrical system.
Single Contingency	See N-1 Contingency.
Solid Dielectric Cable	Copper or aluminum conductors that are insulated by solid polyethylene type insulation and covered by a metallic shield and outer polyethylene jacket.

Source or Sink of Reactive Power	A source of Reactive Power is a device that injects reactive power into the power system (e.g., a Generator or a Capacitor). A sink of Reactive Power absorbs reactive power from the power system. Examples of reactive power sinks are shunt Reactors and motor loads.
Static Compensator	StatCom - a shunt connected power system device that includes Capacitors and Reactors controlled by solid state electronic devices as opposed to mechanically operated switches.
Substation	An assemblage of equipment that switches, changes, or regulates voltage in the electric transmission and distribution system.
Switchyard	A substation that is used as an outlet for one or more electric generators.
Switched Reactive Devices	A shunt Capacitor or shunt Reactor controlled by mechanically operated switches.
Switching Station	Similar to a substation, but there is only one voltage level.
Synchronous Condenser	A rotating mechanical device very similar to a Generator. The Synchronous Condenser has no mechanical power input and cannot produce Real Power. It can only produce or absorb Reactive Power.
System Reliability	See “Reliability”.
Tap	An electrical connection where a new line is connected to an intermediate point on an existing transmission line and a new substation is connected to the end of the new line. A tapped configuration creates a single transmission circuit with more than two end points (for example, a “T”). A tapped configuration is less reliable than a looped configuration because a fault on any portion of the tapped circuit causes a complete loss of power to the new substation. Also, see Loop above.

Tap Changing Transformer	A Transformer that has the ability change the number of windings in service. By changing the number of windings in service (by moving to a different tap), the Tap Changing Transformer has the ability to maintain a nearly constant voltage at its output terminals even though the input voltage to the Transformer may vary.
Thermal Loading Capability	The current-carrying capacity (in Amperes) of a conductor at specified ambient conditions, at which damage to the conductor is non-existent or deemed acceptable based on economic, safety, and reliability considerations.
Thermal overload	A thermal overload occurs when electrical equipment is operated in excess of its current carrying capability. Overloads are generally given in percent. For example, a transmission line may be said to be loaded to 105 percent of its rating.
Thermal rating	See Ampacity.
Transformer	A device that changes the voltage of alternating current electricity.
Transformer Loading Capability	The current-carrying capacity (in Amperes) of a transformer at specified ambient conditions, at which damage to the transformer is non-existent or deemed acceptable based on economic, safety, and reliability considerations.
TSE	Transmission System Engineering.
Underbuild	A transmission or distribution configuration where a transmission or distribution circuit is attached to a transmission tower or pole below (under) the principle transmission line conductors.
Undercrossing	A transmission configuration where a transmission line crosses below the conductors of another transmission line, generally at 90 degrees.

VAr	One Volt ampere reactive. Also see the definition for MVAr.
Voltage Collapse	The point at which the reactive demand at a substation bus exceeds the reactive supply at that bus. When the reactive demand is greater than the supply, the voltage at that point in the system will drop. Eventually, the voltage will drop to a point at which it is no longer possible to serve load at that bus.
Wheeling	A service provided by an entity, such as a utility, that owns transmission facilities whereby it receives electric energy into its system from one party and then uses its system to deliver that energy to a third party. The wheeling entity is usually paid a fee for this service.
WECC	Western Electricity Coordinating Council

LOCAL SYSTEM EFFECTS

Testimony of Mark Hesters and Ajoy Guha

INTRODUCTION

This evaluation was prepared by California Energy Commission staff and provides an analysis of the local electric system effects of the San Francisco Electric Reliability Project. Local system effects are the localized electrical impacts that can be attributed to the addition of a new generator to the grid. The effects assessed in this evaluation include: the potential to defer capital investments, the effect on system losses and reactive power margin, and the ability of the San Francisco Electric Reliability Project to be integrated into the existing and planned system.

The evaluation of local system effects has been included to provide a greater understanding of the effect of the addition of the San Francisco Electric Reliability Project to the grid. Conformance with system reliability criteria is addressed in the Transmission System Engineering section of the Staff Assessment.

Generally, there are two ways to supply power to the San Francisco peninsula. Power may be produced and distributed locally, or power may be produced remotely and shipped into the area through interconnected transmission facilities. The amount of power that can be delivered from remote locations is limited by the capacity of the transmission facilities serving the area. The proposed San Francisco Electric Reliability Project (SFERP), if approved and built, would insert as much as 146 megawatts (MW) of real power and 70 megavars (MVar) of reactive power into the grid, which in turn would help maintain the ability of the Bay Area grid to transport power[1]. As a result, San Francisco Electric Reliability Project plays a key role (along with future transmission upgrades) in the long-term plan to retire older, less efficient Bay Area power plants. San Francisco Electric Reliability Project will also reduce system losses and provide reactive power, thus helping to maintain adequate voltage in the San Francisco peninsula area.

SUMMARY OF CONCLUSIONS

1. The SFERP could reduce transmission system losses or could facilitate the shutdown of the Potrero Power Plant owned by the Mirant Company. If the Potrero Power Plant does not shutdown, the savings to ratepayers have a present value over 20-years between $18 million and $27 million.

[1] In general, electrical energy defined by “real power” measured in megawatts is used to supply lighting, motors, computers and numerous other appliances. “Reactive power”, measured in megavars, supplies voltage support to transport the energy through the electrical transmission system. Real power flow on transmission facilities must not exceed the capability of the transmission facilities. When real power flow is projected to exceed the capability of transmission facilities, either steps must be taken to limit the power flow, or additional or higher capacity equipment must be installed. If reactive power is insufficient, system voltages will decrease, which could lead to the controlled dropping of customer loads (rolling blackouts) and even the uncontrolled loss of load associated with voltage collapse.

As well as reducing the cost of producing power in California, these loss savings would also contribute to a related decrease in the use of fossil fuels, water, and the production of air emissions by reducing the need for additional generation resources. If the Potrero Power Plant Unit 3 shuts down as a result of the SFERP then system losses would actually increase because 207 MW of existing Potrero generation would be replace by only 146 MW from the SFERP.

2. A primary benefit of the addition of the San Francisco Electric Reliability Project (SFERP) is that the old and unreliable Potrero Unit 3 could be released from its Reliability Must Run (RMR) contract and potentially retired. The SFERP has also been identified as one of several upgrades needed to release Potrero Units 4, 5 and 6 from their RMR contracts.
3. Because the SFERP would allow the CA ISO to terminate the Potrero 3 RMR contract, RMR costs would decrease. The CA ISO has also identified the SFERP as one of the projects needed to release Potrero Power Plant Units 4, 5 and 6 from their RMR contracts. Staff has not analyzed the magnitude of the financial impacts of SFERP on RMR costs.
4. The SFERP can be connected to the CA ISO controlled grid with the projects identified in the current transmission plan.
5. No new or modified grid facilities are required to accommodate interconnection of the SFERP. There are no proposed conditions of certification for the LSE topic area.

LAWS, ORDINANCES, REGULATIONS AND STANDARDS (LORS)

Where appropriate, the authors have utilized North American Electric Reliability Council (NERC), Western Electric Coordinating Council (WECC), and CA ISO Grid Planning Standards regarding outages and system reactive margin criteria to assess the benefits or detriments of the SFERP project.

To assure that energy implications are considered in project decisions, California Environmental Quality Act (CEQA) guidelines require that environmental analyses include a discussion of the potential energy impacts of proposed projects with particular emphasis on avoiding or reducing inefficient, wasteful and unnecessary consumption of energy. The CEQA guidelines also require that the decision-maker consider “[t]he effects of the project on local and regional energy supplies and on requirements for additional capacity,…” (CEQA, Appendix F).

SETTING AND AREA RESOURCES

From the transmission perspective the San Francisco Peninsula area is composed of the City and County of San Francisco (CCSF), and the area between Pacific Gas & Electric’s San Mateo substation and San Francisco. Major transmission lines feed the area through the San Mateo and Martin substations, which connect to the 230 kV system (see Figure 1). The 2007 one-in-ten year peak load forecast for San Francisco is 957 MW[2]. Power is supplied to the San Francisco Peninsula area by generation located in the area and across major transmission lines that bring in power from other areas.

GENERATION

The forecasted total local generation in the year 2007 is 383 MW (363 MW from the Potrero Power Plant and 20 MW from the United Cogeneration Plant)[3].

LOCAL SYSTEM EFFECTS Table 1
San Francisco Peninsula Generation

Plant	Unit	Size (MW)	Fuel Type	In-service Date	Operating Restrictions
Potrero	3	207	Natural Gas	1965	Bay Area NOx restrictions
	4	52	Distillate	1976	877 hours/year
	5	52	Distillate	1976	877 hours/year
	6	52	Distillate	1976	877 hours/year
Hunters Point	1*	0 (52)	Distillate	1976	877 hours/year
	2*	0	None	1948	(107 MVAR)
	3*	0	None	1949	(107 MVAR)
	4*	0(163)	Natural Gas	1958	Bay Area NOx restrictions
United Cogen	1	20	Natural Gas	1986	none

*Hunters Point units 1-4 are expected to be shutdown in 2006.

Local System Effects Table 1 shows the generation units currently operating in the San Francisco Peninsula region. The Potrero power plant is old and tends to have frequent outages. The largest and most critical generating unit on the peninsula is Potrero Unit 3 (a steam thermal generating unit), which began operating in 1965, and is significantly beyond the expected 30-year life of a power plant of its type. Potrero Power Plant Units 4, 5, and 6 (52 MW each for a total of 156 MW) are combustion turbines that operate on distillate fuel with high air pollution emissions. These turbines are restricted in operation to 877 hours per year (or about ten-percent of a given calendar year) each according to their Bay Area Quality Management District permits. Therefore, he existing generation in San Francisco is highly vulnerable to disruption and is only available for a limited number of hours every year.

The Hunter Point Power Plant is expected to be completely shut-down by in 2006. Once the Jefferson-Martin 230 kV transmission line project is complete all of the upgrades needed to release the Hunters Point Power Plant from its Reliability Must-Run

[2] For the analysis of loss savings staff used the 957 MW peak forecast for the 2007 one-in-ten year peak for San Francisco the latest one-in-ten peak load forecast for San Francisco is 945 MW in 2007.

[3] The CA ISO, in its Memorandum regarding Action Plan for San Francisco, Options and Risks, describes the transmission and generation projects that are required before the Hunters Point Power Plant from can be released from its Reliability Must Run Contract. All of the transmission facilities required to release the Hunters Point Power Plant from its RMR contract are expected to be complete before the SFERP would be operating. PG&E, the owner of the Hunters Point Power Plant, has agreed to shut down the power plant once the RMR contract is terminated. Thus, the Hunters Point Power Plant would be shutdown when the SFERP could be operational.

(RMR) contract with the CA ISO will be operational. PG&E, the plant owner, has agreed to shutdown the Hunters Point Power Plant when the RMR contract is terminated.

TRANSMISSION

The San Francisco Peninsula receives its power from three sources. Part of the demand is served by power generated locally by San Francisco generation. Part of the San Francisco Peninsula load is served by power delivered to the San Mateo Substation from 230 kV transmission lines connected to the Tesla, Newark via the Ravenswood substation. Part of the San Francisco Peninsula load demand is also met through power delivered to the San Mateo substation via two 230 kV transmission lines crossing San Francisco Bay. Finally, power will be delivered from the Metcalf substation up the Peninsula from a new Jefferson-Martin 230 kV line starting in 2006. Power will flow northward along the Peninsula from the San Mateo and Jefferson Substations to the Martin Substation through the combination of two 230kV transmission lines, and six 115kV transmission lines (see **Figure 1**).

Numerous small shunt capacitors are also used within the local electric distribution system to maintain voltages by supplying reactive power support. Reactive power support cannot be transmitted over long distances and needs to be provided locally. While it is possible to operate a system devoid of local generation, in San Francisco's case this would require substantial new transmission lines to import the required quantity of power, and additional local voltage support devices (i.e., synchronous condensers, shunt capacitors, static Var. compensators etc.)

The operation of the existing power plants in San Francisco has long been contentious. The CCSF and PG&E have had an agreement that PG&E would shut down the Hunters Point Power Plant as soon as it could do so without compromising the reliability of the transmission network. The Maxwell Ordinance (see Attachment 1 for a brief summary) set strict requirements about the retrofit and shut down of existing generation in order for the CCSF to support Mirant's Potrero Power Plant Unit 7 Project. The CA ISO September 10, 2004, Memorandum from Marcie Edwards (CA ISO interim CEO) to the CA ISO Board of Governors clearly lists the transmission and generation projects that need to be in place before the existing Hunters Point and Potrero Power Plants could be released from their RMR contracts and eventually shutdown. All seven of the projects required for the shutdown of Hunters Point Power Plant are expected to be operating before the proposed on-line date of the SFERP. The Potrero Power Plant is currently subject to an RMR contract, with the possibility that the contract would be terminated if and when the SFERP units are built.

LOCAL SYSTEM EFFECTS

The following types of local system effects have been reviewed to assess the potential benefits of local generation:

1. **The Effect on Plans for Transmission Facility Upgrades:** Deferral of capital facilities is determined by identifying proposed facilities for which need is delayed or eliminated because a target generator offsets the need for such facilities. In the case of San Francisco where there has been a public desire to see the existing Hunters Point and Potrero power plants shut down, a new plant or plants could allow for the shutdown of existing plants.
2. **The Effect on System Losses:** Comparing the system with and without SFERP interconnected and operating identifies the increase or decrease in losses.
3. **Impact on RMR Costs:** Would the proposed project increase or decrease RMR costs?
4. **Ability to be integrated into existing and planned system:** Would major system additions or system modifications be needed to accommodate the new facility?
5. **Affect on System Reliability:** Would the project increase or decrease system reliability?

THE EFFECT ON PLANS FOR TRANSMISSION FACILITY UPGRADES

As stated earlier, power will be supplied to customers on the San Francisco Peninsula either through local generation or through transmission facilities that run in a northward loop along the Peninsula from the Jefferson and San Mateo Substation. Additional generation on the Peninsula can reduce the need for additional transmission facilities into the Peninsula but, given the potential retirement of existing generation in the Bay Area, staff is unable to attribute the deferral of any planned transmission facilities directly to the SFERP. The SFERP could be a component of a reliable network when the existing generators are allowed to retire.

Over the next five to ten years the addition of the SFERP will probably not defer any identified major transmission facilities. The CA ISO has developed a plan for the San Francisco Peninsula to insure that network will meet reliability criteria under a variety of load and resource scenarios from 2011 to 2016. Given the large number of scenarios that include the analysis of generation retirement and a potential Direct Current (DC) line from the East Bay to San Francisco it will be very hard to determine the impact of a single project like the SFERP on the need for transmission facilities. Transmission facilities that could be deferred by the SFERP could be offset by the retirement of other plants making the deferrals uncertain. The SFERP could allow for the retirement of existing generators.

Based on the CA ISO Action Plan for San Francisco Memorandum the SFERP and one additional new gas turbine are needed in order to allow the CA ISO to release Potrero unit 3 from its Reliability Must Run contract (CA ISO 2004a). While release from the

RMR contracts would allow the Potrero units to shut down, they are privately owned and would be free to operate in the energy market. According to the CA ISO Action Plan for San Francisco, new generation similar to the SFERP in San Francisco is required in order to release Potrero 3 from its RMR contract and that generation is also required for the eventual release of Potrero Units 4, 5 and 6 from their RMR contracts. The Potrero units will not be allowed to shutdown until they are released from their RMR contracts.

Thus, while the SFERP may not defer transmission facilities it is a key component in the plan to end the Potrero 3 RMR contract as well as eventually ending the RMR contracts for Potrero 4, 5 and 6.

THE EFFECT ON SYSTEM LOSSES

Transmission system losses are a function of generation schedules, imports, exports, wheeling and system loop flow in addition to load. Transmission line losses occur as a result of conductor resistance and corona discharge. Resistance line losses are significant, especially on long, heavily loaded lines with a high load factor (75 percent - 100 percent). Typical values for utility systems in California range from 12 kW/mile to 500 kW/mile for line loadings between 25 percent and 100 percent of the conductor ratings. These losses are similar to the operation of electric strip heaters for home and building use where heat is produced by connecting a resistor heating element across 120V or 240V, and allowing the current to flow through the resistor element.

Based on the predicted 2007 Northern California system peak demand of 26,000 MW, the primary system losses (transmission lines and transformers) are approximately 916 MW without SFERP operating (and with Potrero Units 3, 4, 5 and 6 operating). Transmission losses thus constitute 3.5 percent of the load. Staff did not study the change in losses with the SFERP operating and Potrero Unit 3 shutdown; however since this would result in a net loss of about 60 MW of generation in San Francisco there would be an increase in system losses.

Transmission line losses were assessed for six dispatch scenarios. These dispatch scenarios were selected to bracket the range of dispatch conditions that occur in an actual year. Because the power supplied to the system must equal the system load plus the losses, when SFERP operates, 146 MW of generation as shown by the dispatch scenarios must be reduced to balance the additional 146 MW from SFERP. The baseline for comparison was the system losses without SFERP. Losses with SFERP on line and other units redispatched according to the established dispatch scenarios were then compared to the baseline.

The following dispatch scenarios were studied for the year 2007 to allow for the addition of the 146 MW SFERP:

1. Moss Landing Power Plant output reduced 146 MW.
2. Delta Energy Center output reduced 146 MW.
3. Metcalf Energy Center output reduced 146 MW.
4. Contra Costa Power Plant output reduced 146 MW.
5. Sutter Power Plant Project output reduced 146 MW.

6. Northwest Imports reduced 146 MW.

By adding SFERP and reducing generation as depicted in the dispatch scenarios, system peak loss reductions range between 6 MW and 21 MW for the different scenarios (See Appendix A, Table I). The additional 6 to 21 MW is “produced” without the use of any additional fuel or water and without producing any additional plant emissions.

To estimate the annual energy savings staff assigned probabilities to the various dispatch scenarios tested. Multiplying the unique dispatch related loss reduction value by the assigned dispatch probability provided an expected overall MW loss reduction value for the study year: 10.4 MW in 2007. The estimated annual energy savings that correspond to the expected overall system loss reduction values noted above are 27.5 GWh in year 2007. These amounts of energy savings are equivalent to the annual energy requirement for approximately 4,100 homes[5]. A reduction in system losses of this magnitude would save ratepayers $1.8 to $2.7 million per year. Over a twenty-year period, the present value of these savings to ratepayers is $18 to $27 million. In calculating these values for the loss savings, the following assumptions were made:

- Natural gas prices are $5 - $7/MMBtu,
- The displaced unit’s heat rate is 13,000 – 14,000 Btu/kWh,
- Any emissions offsets created were valued at $0 (a very conservative assumption), and
- The rate of return is 8 percent.

The calculations for this analysis are contained in Appendix A, Table II, for the study year 2007.

If the Potrero Power Plant Unit 3 shuts down as a result of the interconnection and operation of SFERP then system losses will actually increase. The SFERP and the additional unit at the airport would produce less than 200 MW while the Potrero 3 can produce 210 MW. Thus, if Potrero 3 shuts down when the SFERP and the unit at the airport begin operating, the San Francisco region will actually see a decrease in local generating capacity and there would be an associated increase in system losses.

To assure that energy implications are considered in project decisions, environmental documents must include a discussion of the potential energy impacts of proposed projects. This discussion places particular emphasis on avoiding or reducing inefficient, wasteful and unnecessary consumption of energy and the project’s effect on local and regional energy supplies. Most decision-makers generally are faced with only the negative energy use considerations when approving a project that may result in significant increased use of energy. This Commission faces a different situation in that SFERP may reduce energy losses while providing numerous other benefits. If one anticipates that SFERP, if built, would operate for at least 20 years, there are long-term

[5] For this estimate staff assumed that an average household in California uses 6,600 KWh of energy annually.

environmental benefits related to reduced fuel and water use and to reduced emissions due to the reduction in electricity system losses.

RELIABILITY MUST RUN COSTS

According to the CA ISO's Action Plan for San Francisco, the SFERP plus one additional turbine at the San Francisco airport must be operating before Potrero Unit 3 can be released from its RMR contract. Thus ratepayers would be saved the costs of the RMR contracts for Potrero Unit 3. Staff has not calculated the savings in RMR costs. The SFERP is also an essential part of the plan to release Potrero Unit 4, 5 and 6 from their RMR contracts which would be an additional benefit of the proposed project.

ABILITY TO BE INTEGRATED INTO EXISTING AND PLANNED SYSTEM

Based on the various studies from PG&E (SFERP2004b and SFERP2004p), the SFERP can be connected to the CA ISO controlled grid with the projects identified in the current transmission plan and if several system protection schemes are implemented. There is no evidence that any existing facilities or the additional facilities planned to be added to the CA ISO controlled grid through 2007 will need to be modified because of the addition of SFERP.

AFFECT ON SYSTEM RELIABILITY

The SFERP would provide both real and reactive power to the grid in San Francisco. The reactive power, 70 MVAR, will increase the local reactive margin unless the Potrero Unit 3 is shut in which case reactive margin in the San Francisco area would actually decrease (see Appendix B, Tables I and II) and improve system reliability and voltage in the area. Staff did not study the change in reactive margin with the SFERP and without Potrero Unit 3.

CONCLUSIONS

1. The SFERP could reduce transmission system losses or could facilitate the shutdown of the Potrero Power Plant. If the Potrero Power Plant does not shutdown, the savings to ratepayers have a present value over 20-years between $18 million and $27 million. As well as reducing the cost of producing power in California, these loss savings would also contribute to a related decrease in the use of fossil fuels, water, and the production of air emissions by reducing the need for additional generation resources. If the Potrero Power Plant shuts down as a result of the SFERP then system losses could actually increase.
2. Not withstanding the potential for an increase in system losses as discussed above, a primary benefit of the addition of the San Francisco Electric Reliability Project (SFERP) is that the old and unreliable Potrero Unit 3 could be released from its Reliability Must Run (RMR) contract and potentially retired. The SFERP has also been identified as one of several upgrades needed to release Potrero Units 4, 5 and 6 from their RMR contracts.
3. Because the SFERP would allow the CA ISO to terminate the Potrero 3 RMR contract RMR costs would decrease. The CA ISO has also identified the SFERP as one of the projects needed to release Potrero Power Plant Units 4, 5 and 6 from

their RMR contracts. Staff has not analyzed the magnitude of the financial impacts SFERP on RMR costs.

4. The SFERP can be connected to the CA ISO controlled grid with the projects identified in the current transmission plan. No new or modified grid facilities are required to accommodate interconnection of the SFERP.

CONDITIONS OF CERTIFICATION

Staff has concluded that no conditions of certification are required for this area.

REFERENCES

CA ISO2004a - California Independent System Operator, Action Plan for San Francisco, Options and Risks, Memorandum from Marcie Edwards to the CA ISO Board of Governors, September 10, 2004.

CA ISO2003a - California Independent System Operator, San Francisco Peninsula Load Serving Capability, July 3, 2003.

CCSF 2001a - (City and County of San Francisco). CCSF Ord. Final CCSF Ordinance of May 29, 2001. Submitted to California Energy Commission, June 12, 2001.

SFERP2004a - City and County of San Francisco/Blout (tn:31130). Application for Certification San Francisco Electric Reliability Project - 145-megawatt natural gas-fired peaking power plant located in San Francisco. Submitted to CEC/Therkelsen/Dockets on 3/18/04.

SFERP2004b - CH2MHill/Carrier (tn:31126). Transmittal of Appendix 5, System Impact Study. Submitted to CEC/Pfanner/Dockets on 3/18/04.

SFERP2004g - CH2MHill/Carrier (tn:31268). Data Adequacy Supplement. Submitted to CEC/Pfanner/Dockets on 4/16/04.

SFERP2004p – CH2MHill/Carrier (tn:31858). Data Responses Set 1A. Attachment TSE-70A, Updating Facilities Study. Submitted to CEC/Pfanner/Dockets on 7/6/04.

ATTACHMENT 1

MAXWELL ORDINANCE

An important consideration in determining the benefits of the Unit 7 project is the Maxwell ordinance which was approved by the San Francisco Board of Supervisors on May 29, 2001. This ordinance sets several requirements for City staff to consider supporting the permitting of Unit 7. Briefly these requirements are:

- Hunters Point Power Plant will cease operation as a fossil generation plant within 90 days of the operation of Unit 7.
- Potrero Power Plant Units 4 through 6 will be retrofitted or rebuilt with the best available pollution control technology (BACT) and will operate only during specified times.
- Potrero Power Plant Unit 3 will shut down as soon as it is no longer needed to sustain electric reliability in San Francisco. (CCSF Ord, Pages 2-4).

APPENDIX A

TABLE I

SFERPP LOSS ANALYSIS-YEAR 2007

TOTAL PG&E System Losses / System Loss Reduction

	PG&E SYSTEM LOSS PRE-PROJECT (MW)	PG&E SYSTEM LOSS WITH SFERPP 3 UNITS (MW)	SYSTEM PEAK LOSS REDUCTION (MW)	EXPECTED PEAK LOSS REDUCTION (MW)	ANNUAL ENERGY SAVED (GWh)	EXPECTED ANNUAL ENERGY SAVED (GWh)
Base Dispatch, PG&E Assesment 2007 Summer peak, Swing= Morro Bay unit 4. Potrero 7 and SFERPP units are off line.	916.49					
Dispatch 1, Local Adjustment : SFERPP = +146 MW, Duke Moss= -146 MW, Potrero 7 units off line.		907.13	9.36	1.68	27.62	4.97
Dispatch 2, Local Adjustment : SFERPP = +146 MW, Delta Energy= -146 MW, Potrero 7 units off line.		905.29	11.20	2.02	33.05	5.95
Dispatch 3, Local Adjustment: SFERPP = +146 MW, Metcalf = -146 MW, Potrero 7 units off line.		908.59	7.90	1.42	23.31	4.20
Dispatch 4, Local Adjustment: SFERPP = +146 MW, Contra Costa= -146 MW, Potrero 7 units off line.		905.34	11.15	2.01	32.90	5.92
Dispatch 5, Local Adjustment: SFERPP = +146 MW, Sutter= -525 MW, Potrero 7 units off line.		910.32	6.17	1.11	18.20	3.28
Dispatch 6, Remote Adjustment: SFERPP = +146 MW, COI= -146 MW, Potrero 7 units off line.		894.88	21.61	2.16	63.76	3.19
Totals:				**10.40**		**27.50**
Average:			**11.23**		**33.14**	--

NOTE: Calculations for expected MW Peak loss & Energy savings and related present value in dollars are illustrated in Appendix A, Table II

APPENDIX A
TABLE II

SFERPP LOSS ANALYSIS-YEAR 2007
TOTAL PG&E System Losses / System Loss Reduction

	PG&E SYSTEM LOSS PRE-PROJECT (MW)	PG&E SYSTEM LOSS WITH SFERPP 3 UNITS (MW)	SYSTEM PEAK LOSS REDUCTION (MW)	PROBABILITY OF THE REDISPATCH SCENAIRIO	EQUIVALENT PEAK LOSS REDUCTION (MW)	SYSTEM ANNUAL LOAD FACTOR	EQUIVALENT HOURS LOSS FACTOR	ANNUAL ENERGY SAVED (GWh)	PROBABLE ANNUAL ENERGY SAVED (GWh)	ADJUSTMENT FACTOR FOR REMOTE DISPATCH	ADJUSTED PROBABLE ANNUAL ENERGY SAVED (GWh)
Base Dispatch, PG&E Assesment 2007 Summer peak, Swing= Morro Bay unit 4. Potrero 7 units and SFERPP 3 units are off line.	916.49										
Dispatch 1, Local Adjustment : SFERPP= +146 MW, Duke Moss= -146 MW, Potrero 7 units off line.		907.13	9.36	0.18	1.68	0.57	0.34	27.62	4.97	1.00	4.97
Dispatch 2, Local Adjustment : SFERPP= +146 MW, Delta Energy = -146 MW, Potrero 7 units off line		905.29	11.20	0.18	2.02	0.57	0.34	33.05	5.95	1.00	5.95
Dispatch 3, Local Adjustment: SFERPP= +146 MW, Metcalf = -146 MW, Potrero 7 units off line.		908.59	7.90	0.18	1.42	0.57	0.34	23.31	4.20	1.00	4.20
Dispatch 4, Local Adjustment: SFERPP = +146 MW, Contra Costa= -146 MW, Potrero 7 units off line.		905.34	11.15	0.18	2.01	0.57	0.34	32.90	5.92	1.00	5.92
Dispatch 5, Local Adjustment: SFERPP = +146 MW, Sutter= -146 MW, Potrero 7 units off line.		910.32	6.17	0.18	1.11	0.57	0.34	18.20	3.28	1.00	3.28
Dispatch 6, Remote Adjustment: SFERPP = +146 MW, COI= -146 MW, Potrero 7 units off line.		894.88	21.61	0.10	2.16	0.57	0.34	63.76	6.38	0.50	3.19
Totals:				**1.00**	**10.40**				**30.69**		**27.50**
Average:			**11.23**					**33.14**			--

		Gas Cost ($/MMBtu)	Heat Rate (Btu/kWh)
Energy Savings (GWh)	**27.50**	**$3.72**	**12000**
Cost of Energy ($/MWh)	$44.64		
Total Savings per year in 1000 ($)	**$1,227.64**		
Total Savings per year in million ($)	$1.23		
Number of Years	**20**		
Interest Rate (%)	**8%**		
Present Value of Savings in 1000 ($)	$12,053.15		
Present Value of Savings in million ($)	**$12.05**		

		Gas Cost ($/MMBtu)	Heat Rate (Btu/kWh)
Energy Savings (GWh)	**27.50**	**$5.90**	**13000**
Cost of Energy ($/MWh)	$76.70		
Tot. Savings per year in 1000 ($)	**$2,109.32**		
Total Savings per year in million ($)	$2.11		
Number of Years	**20**		
Interest Rate (%)	**8%**		
Pr. Value of Savings in 1000 ($)	$20,709.61		
Pr. Value of Savings in million ($)	**$20.71**		

APPENDIX B
TABLE I
SFERP
TABLES FOR REACTIVE POWER MARGIN
(Without SVC At Potrero Plant)

N-1 Contingency Case: Jefferson - Martin C 230 kV Line

Load Flow Scenario	Monitored Bus	'Nose-Point' without SFERP Units (MVAr)	'Nose-Point' with SFERP Units (MVAr)	+/- Change in Bus Reactive Power Margin (MVAr)
Year 2007 Summer Peak	Potrero 115 kV	-901	-982	+81
	Mission 115 kV	-866	-943	+77
	Bayshore2 115 kV	-884	-963	+79
	Martin C 115 kV	-959	-1047	+88

N-2 Contingency Case: Martin C – San Mateo 230 kV Line + Potrero Gen. Unit 3

Load Flow Scenario	Monitored Bus	'Nose-Point' without SFERP Units (MVAr)	'Nose-Point' with SFERP units (MVAr)	+/- Change In Bus Reactive Power Margin (MVAr)
Year 2007 Summer Peak	Potrero 115 kV	-687	-779	+92
	Mission 115 kV	-657	-745	+88
	Bayshore2 115 kV	-675	-764	+89
	Martin C 115 kV	-742	-843	+101

N-2 Contingency Case: Martin C – San Mateo 230 kV Line and Jefferson – Martin C 230 kV Line

Load Flow Scenario	Monitored Bus	'Nose-Point' without SFERP Units (MVAr)	'Nose-Point' with SFERP Units (MVAr)	+/- Change in Bus Reactive Power Margin (MVAr)
Year 2007 Summer Peak	Potrero 115 kV	-678	-772	+94
	Mission 115 kV	-657	-745	+88
	Bayshore2 115 kV	-668	-760	+92
	Martin C 115 kV	-710	-811	+101

APPENDIX B
TABLE II
SFERP
TABLES FOR REACTIVE POWER MARGIN
(With SVC At Potrero Plant)

N-1 Contingency Case: Jefferson - Martin C 230 kV Line

Load Flow Scenario	**Monitored Bus**	**'Nose-Point' without SFERP Units (MVAr)**	**'Nose-Point' with SFERP Units (MVAr)**	**+/- Change in Bus Reactive Power Margin (MVAr)**
Year 2007 Summer Peak	Potrero 115 kV	-916	-975	+59
	Mission 115 kV	-880	-937	+57
	Bayshore2 115 kV	-898	-956	+58
	Martin C 115 kV	-974	-1040	+66

N-2 Contingency Case: Martin C – San Mateo 230 kV Line + Potrero Gen. Unit 3

Load Flow Scenario	**MONITORED BUS**	**'Nose-Point' without SFERP Units (MVAr)**	**'Nose-Point' with SFERP units (MVAr)**	**+/- Change In Bus Reactive Power Margin (MVAr)**
Year 2007 Summer Peak	Potrero 115 kV	-701	-772	+71
	Mission 115 kV	-672	-738	+66
	Bayshore2 115 kV	-689	-757	+68
	Martin C 115 kV	-757	-836	+79

N-2 Contingency Case: Martin C – San Mateo 230 kV Line and Jefferson – Martin C 230 kV Line

Load Flow Scenario	**Monitored Bus**	**'Nose-Point' without SFERP Units (MVAr)**	**'Nose-Point' with SFERP Units (MVAr)**	**+/- Change in Bus Reactive Power Margin (MVAr)**
Year 2007 Summer Peak	Potrero 115 kV	-692	-766	+74
	Mission 115 kV	-671	-739	+68
	Bayshore2 115 kV	-683	-754	+71
	Martin C 115 kV	-725	-805	+80

LOCAL SYSTEM EFFECTS
San Francisco Electric Reliability Project - Regional Setting

CALIFORNIA ENERGY COMMISSION, ENERGY FACILITIES SITING & ENVIRONMENTAL PROTECTION DIVISION, FEBRUARY 2006
SOURCE: California Energy Commission Statewide Transmission Line & Power Plant maps/2004 & USGS 7.5 Minute Quadrangles